Woodworker's Journal

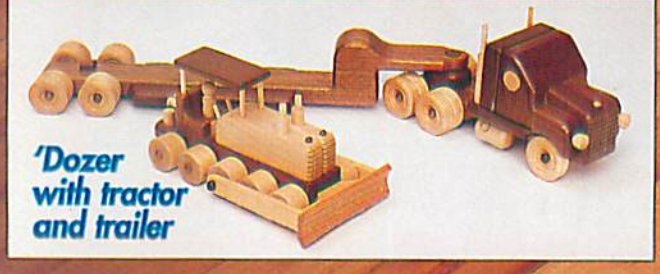
Vol. 19, No. 2 March/April 1995

Curly Maple Hunt Board

■ Turning A Basic Lidded Box:
3 Design Options

■ Tool Review
We Test 5 Oscillating Spindle Sanders Under $350

■ Projects
- *Tool Cabinet*
- *Keeping Chest*
- *Toy Bulldozer And Semi Rig*
- *Biscuit-Slotting Jig*
- *Courting Flute*



'Dozer with tractor and trailer

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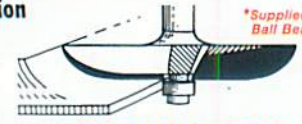

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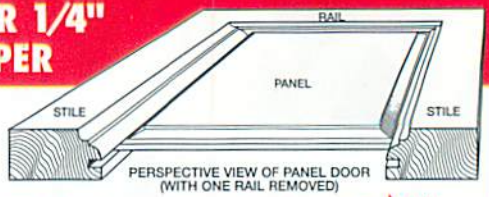

PERSPECTIVE VIEW OF PANEL DOOR (WITH ONE RAIL REMOVED)

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#1315	ROUND OVER - 3/16" Radius	1/4"	$11.00
#1368	ROUND OVER - 1/4" Radius	1/4"	$12.00
#1316	ROUND OVER - 5/16" Radius	1/4"	$14.00
#1369	ROUND OVER - 3/8" Radius	1/4"	$15.00
#1370	ROUND OVER - 1/2" Radius	1/4"	$17.00
#1317	ROUND OVER - 1/4" Radius	1/2"	$12.00
#1318	ROUND OVER - 3/8" Radius	1/2"	$15.50
#1319	ROUND OVER - 1/2" Radius	1/2"	$17.00
#1320	ROUND OVER - 3/4" Radius	1/2"	$21.00
#1333	TONGUE & GROOVE - Straight	1/4"	$29.00
#1334	TONGUE & GROOVE - Straight	1/2"	$29.00
#1335	TONGUE & GROOVE - Wedge	1/4"	$29.00
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#1365	1" C.L.	1/4"	$31.95
#1366	1-11/16" C.L.	1/2"	$31.95
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#1331	BULL NOSE - 3/4" Diameter of Circle	1/4"	$21.00
#1332	BULL NOSE - 3/4" Diameter of Circle	1/2"	$21.00
#1371	STRAIGHT - 1/4" Diameter	1/4"	$ 6.50
#1372	STRAIGHT - 3/8" Diameter	1/4"	$ 6.50
#1373	STRAIGHT - 1/2" Diameter	1/4"	$ 7.00
#1374	STRAIGHT - 3/4" Diameter	1/4"	$ 9.50
#1375	STRAIGHT - 3/8" Diameter	1/2"	$ 7.50
#1376	STRAIGHT - 1/2" Diameter	1/2"	$ 8.00
#1377	STRAIGHT - 3/4" Diameter	1/2"	$10.00
#1378	COVE - 1/4" Radius	1/4"	$12.00
#1379	COVE - 3/8" Radius	1/4"	$13.00
#1380	COVE - 1/2" Radius	1/4"	$14.00
#1381	COVE - 1/2" Radius	1/2"	$15.00
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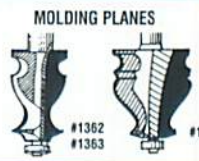

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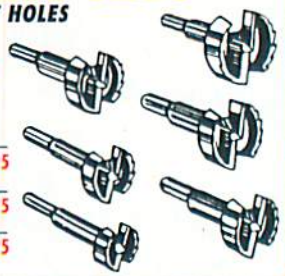

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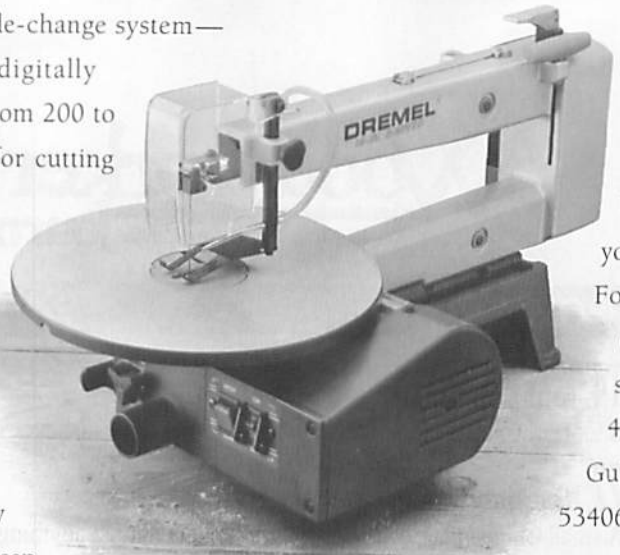

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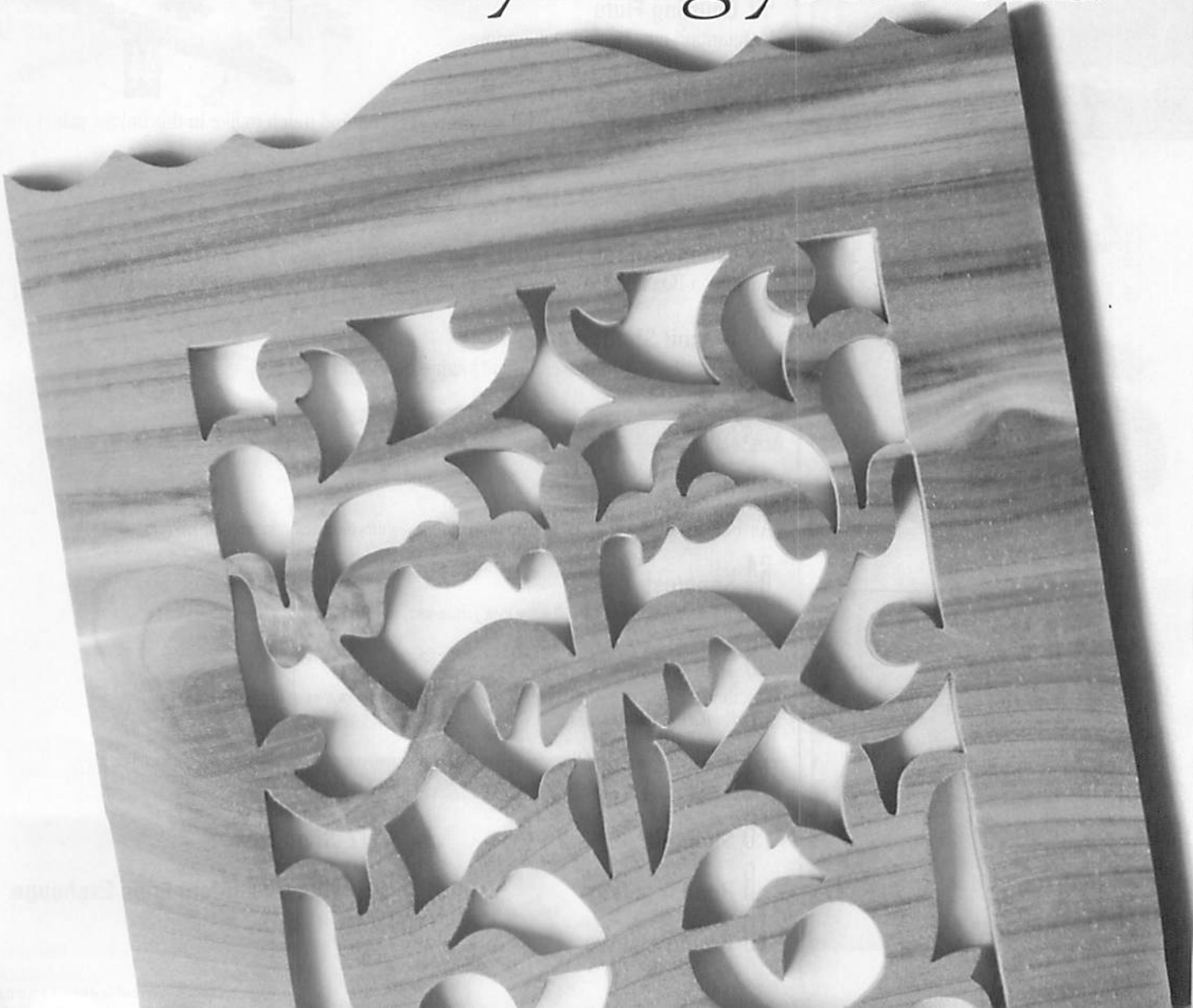

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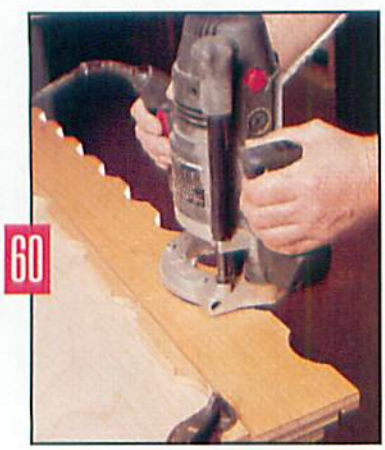

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Woodworker's Journal

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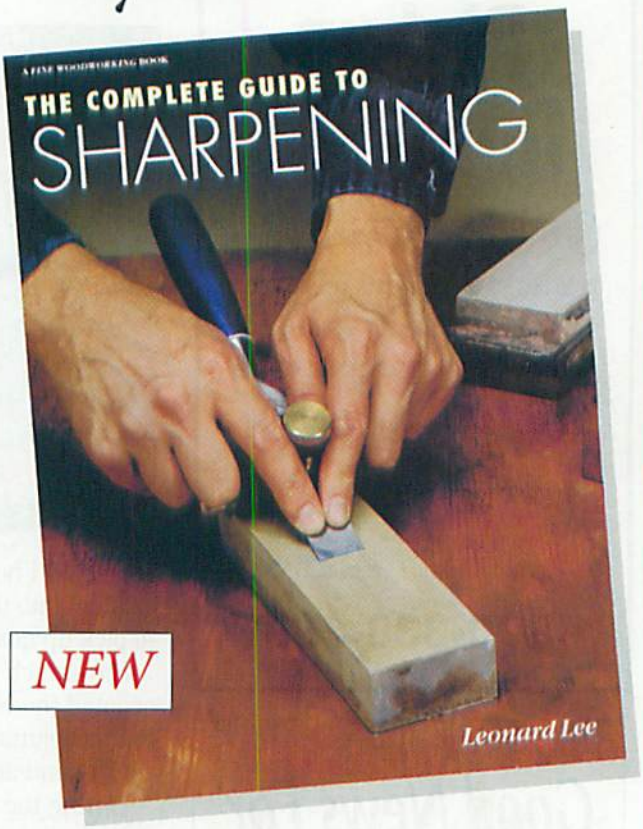

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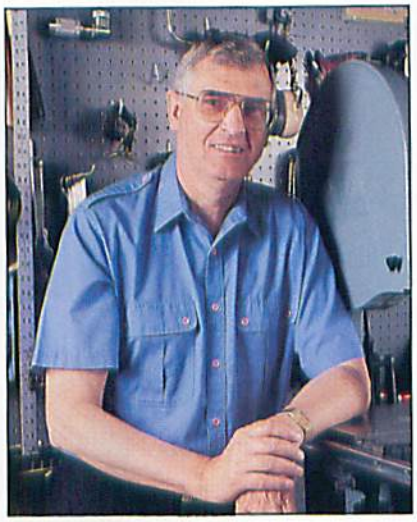
Good News For Woodworking Anglers:

Our upcoming May/June issue features Craig Brown's fly box and landing net—striking designs that any fisherman will rise to. Bob Colpetzer helps you wade through these two challenging projects.

SHOP TALK



More Tools, Better Tools

I've been actively woodworking for about 35 years. During this time, I've seen—as many of you have—an evolution in the quantity and quality of tools available to us as home woodworkers.

When I first started woodworking, we scoured newspaper ads and routinely attended auctions looking for suitable commercial- and industrial-grade tools that we could feasibly incorporate into our shops. I acquired my first jointer and a stationary belt/disc sander as castoffs from a commercial cabinet shop, and I helped move a few backbreaking tablesaws, planers, and shapers into the shops of others. Back then, this was one of the best ways to pick up quality woodworking equipment at reasonable prices.

How much this situation has changed became evident to me as I scouted the National Hardware Show and the International Woodworking Fair last summer. At one show or the other, I saw and handled just about every hand and power tool you could buy for a shop.

During the past six months, I've also visited Porter-Cable's Jackson, Tennessee, plant and Makita's manufacturing facility at Buford, Georgia. I'm not an engineer or metallurgist, but I was impressed with the quality and precision that went into the tools I saw being made.

I came away from these tours with a new appreciation for what bargains many of our tools are today. Recently, I skimmed through a few of our 1977 and 1978 issues to check advertised tool prices. Back then, prices weren't commonly listed in ads, but I did find a few items to compare. For example, one supplier offered Makita's 3/8" variable-speed, reversing hand drill for $92 and their 3x24" belt sander with dust bag for $108. You'll pay $95 for about the

Automation helps some manufacturers hold down tool prices. Here, Clark Vaughters operates the final inspection station for motor armatures at Makita Corporation of America's highly automated plant near Buford, Georgia.

same 3/8" drill today, and a newer version of that belt sander can be had for $184. I found a Hegner Multicut scrollsaw listed at $599 and a Rockwell 1/4-sheet palm sander discounted to $53.98. Today, you can buy an almost identical version of the sander for $58.

Yes, tool prices have gone up. The tablesaw that I looked at longingly 15 years ago (and thought it too pricey then) has roughly doubled in price. But, as these comparisons indicate, few tool-price increases have come close to matching the inflationary pace we've seen for cars and similar items. Factor in product improvements, such as variable-speed motors and dust-collecting capability, and I think you'll agree that today's tools continue to be good bargains.

Charles Sommers

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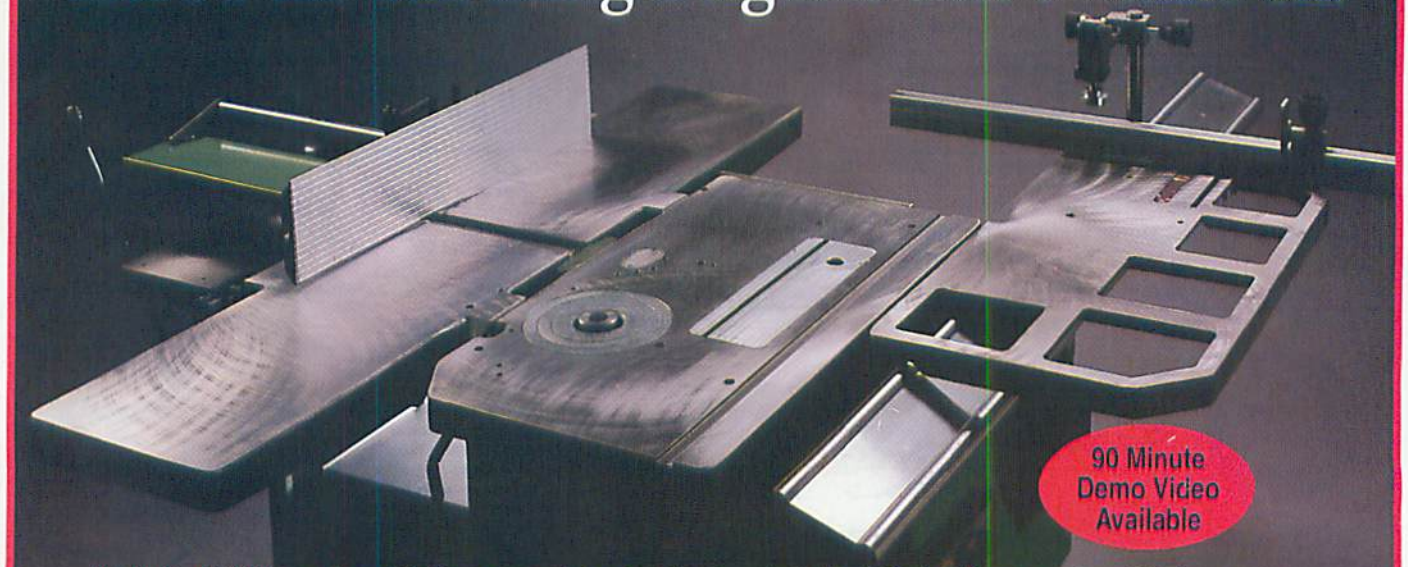

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READER LETTERS

While reading your Nov./Dec. '93 issue, my attention was drawn to the wooden bowl on page 32. Not having prior turning experience, I made the bowl using hardwood cutoffs from my shop.

Chalice and bowl created by Thomas McDonnell

Soon after completing the bowl, I attended church in Hartford, New York, where my daughter is pastor. I noted that the church had a communion plate but no bowl, and it occurred to me that creating a chalice to match the bowl would be a great challenge. The enclosed photograph shows the result of my efforts. Thanks for the idea.

Thomas McDonnell, Fort Edward, N.Y.

It was about time someone came up with the PROJECT-PAKs that Heritage Building Specialties offers. Here in the northeast, the price of good wood for projects featured in yours and other woodworking publications is totally off the wall. Heritage, on the other hand, supplies you with just enough wood to complete the project, at an affordable price, and without a lot of leftover.

I have dealt with Heritage several times now, and have been very satisfied with the quality and price. The beauty of doing business with them is you can call an 800 telephone number and speak to Paul Thieme direct. He does his best to see that you get what you pay for and then some.

Tom Tyrrell, Teaneck, N.J.

Thanks, Tom, for your complimentary words about PROJECT-PAKs and Heritage. We're happy to make these kinds of reader services available, and invite you

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and all readers to suggest other services that would be helpful to you.

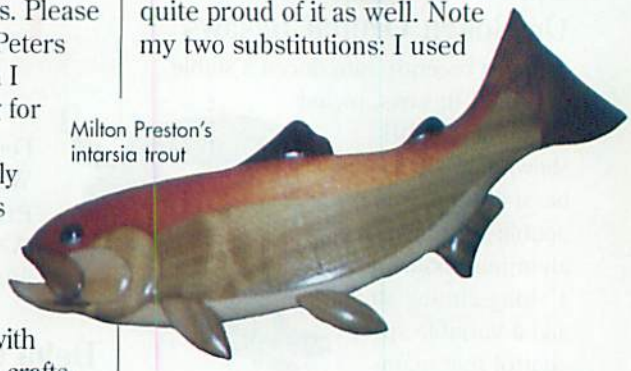
Enclosed is a photo of my first intarsia effort. I am now making my second eagle, and plan to do two trout to go with the birds. Please convey my thanks to David Peters for his encouragement when I called him last spring asking for help on the contouring.

Debra Anderson with her first eagle intarsia

Our family traditionally draws names and makes gifts for Christmas. Projects from *Woodworker's Journal* have been used many times with great satisfaction for the craftsman and happy recipient alike.

Debra Anderson, White Lake, Mich.

I made the trout intarsia from your Sept./Oct. '94 issue and gave it to my son for his birthday. He now displays it proudly in his office. It was my first attempt at intarsia, so I'm quite proud of it as well. Note my two substitutions: I used mahogany for the trout's back, mahogany sapwood for its tail.



Milton Preston's intarsia trout

Milton Preston, Hendersonville, NC

We welcome opinions and comments (both pro and con) from our readers. Address correspondence to: Letters Dept., *Woodworker's Journal*, News Plaza, P.O. Box 1790, Peoria, IL 61656. Please include your full name, address, and telephone number.

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Pardon Our Error!

In last issue's intarsia project, the Eight-Point Buck (Jan./Feb. 1995), the instructions on *page 42* specify a 150% enlargement for the patterns. Please ignore this, and enlarge them to 200% as indicated on the pattern pages.

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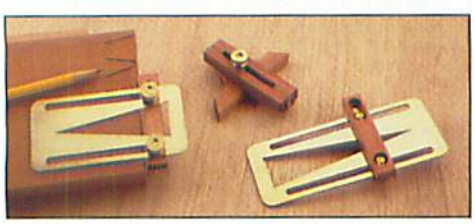
PRODUCT NEWS

Blade Changing a "Clic" On Bosch Orbital Jigsaws

Bosch recently introduced a stable of orbital jigsaws, including model B4201 shown here. This unit has a 4.8-amp motor, double-insulated aluminum housing, a 1"-long cutting stroke, and a variable speed control that maintains optimum blade speed between 500 and 3,100 strokes per minute. A four-position switch allows you to change the orbital action to better match the material being cut. It also incorporates the manufacturer's "Clic" blade-changing system, enabling you to change blades without tools. And, the footplate can be retracted for flush-cutting or tilted up to 45° for bevel-cutting. For more information, contact S-B Power Tool Company, 4300 W. Peterson Ave., Chicago, IL 60646, telephone 312/286-7330.

Adjustable Marking Gauges For Easy, Accurate Dovetails

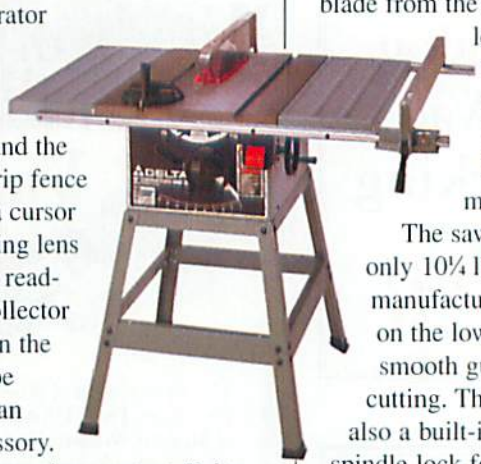
Tight-fitting hand-cut dovetails require accurate marking of the pins and tails. These adjustable brass and pau ferro marking gauges, shown *below*, will help ensure that you get that accuracy every time. They adjust for angled or straight dovetails up to 1" wide and come in 1:6 pitch for softwoods, 1:8 pitch for hardwoods. Use the mini cutting gauge to mark cutting depths on dovetails or anywhere accurate marking on small pieces is needed.



For more information, contact Woodcraft Supply Corporation, P.O. Box 1686, Parkersburg, WV 26102-1686, telephone 304/464-5286.

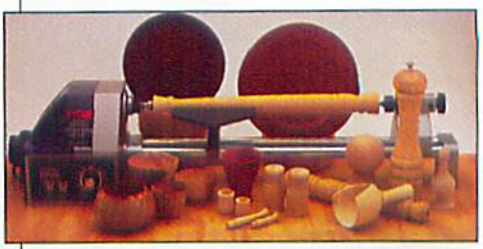
Delta Contractor's Saw II

Delta's original 10" contractor's tablesaw has enjoyed years of popularity with woodworkers, and the firm's newest introduction will likely continue that tradition. The new saw incorporates a one-piece, cast-iron carriage and trunnion assembly, a 1½-hp induction motor, a 27x40" cast-iron table with miter-gauge grooves, and two extension wings. A large on/off paddle switch has been mounted up front for fast, easy operator access. The miter gauge has stops at 45° and 90°, and the self-aligning rip fence incorporates a cursor with magnifying lens for easy scale reading. A dust collector that mounts on the carriage can be purchased as an optional accessory. For more information, contact Delta International Machinery Corporation, 246 Alpha Drive, Pittsburgh, PA 15328, telephone 800/438-2486.



Ryobi's Mini-Sized Lathe Turns With A Mini-Sized Price

If you'd like to try your hand at turning but get turned off by the prices of most woodturning lathes, then Ryobi's mini-model (ML618) should interest you. Although small in size compared to most lathes, this unit can turn spindles up to 18" long and plates up to 6" in diameter (10" if you release the head from the tool rest). A dial-type control allows you to select operating speeds of 500 to 2,500 rpm. For additional information, contract Ryobi North America, 5201 Peaman Dairy Road, Anderson, SC 29622-1207, telephone 800/525-2579.



Porter-Cable's Circular Saw Goes Left

They've finally done it—moved the blade from the right side around to the left side—and all right-handed users should enjoy a better view of the cut line using Porter-Cable's new model 743 FRAME saw. The saw, shown *below*, weighs only 10¼ lbs. and features the manufacturer's exclusive miter lip on the lower blade guard for smooth guard action while cutting. There's also a built-in spindle lock for easy blade changing, and the adjustable footplate has positive stops at 45° and 90°. The saw will be offered in three versions: the standard 743 FRAME, an electric-brake model, and a kit that includes a steel carrying case. For more information, contact the Porter-Cable Corporation, P.O. Box 2468, Jackson, TN 38302-2468, telephone 901/668-8600.

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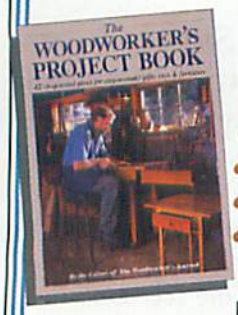

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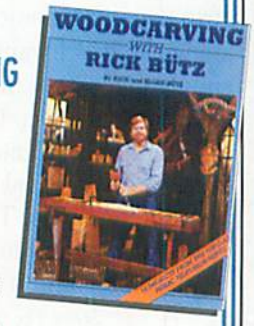

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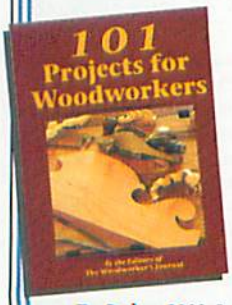

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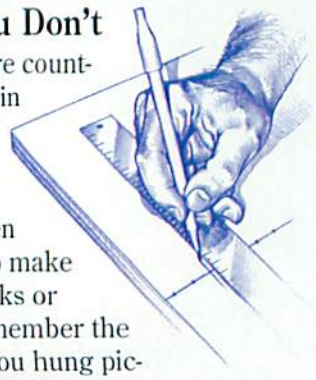


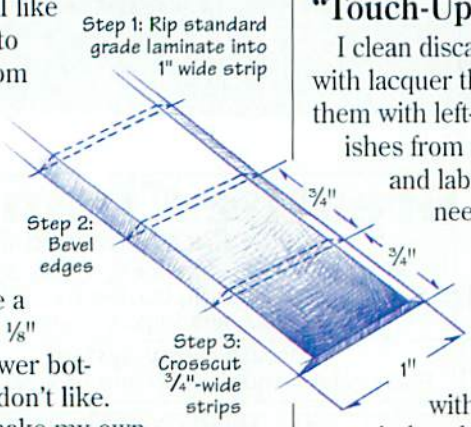
There are countless times in the workshop and around a house when we need to make pencil marks or lines. (Remember the last time you hung pictures on the living room wall?) But, removing the lines afterwards can be a real hassle.

Not with my latest discovery—the Dritz disappearing-ink marking pen. With it you can mark just about anything—fabric, wood, painted walls—you name it. (We suggest testing each use first.) Depending on conditions, the ink will automatically disappear in a day or two. Or, you can wipe the marks with a damp cloth to remove them immediately. Dritz markets the $2.25 pens in sewing and fabric stores.

James Hunter, Traverse City, Mich.

Homemade Drawer Glides Prevent Rubbing

I build a lot of cases with inset drawers, and I like to use glides to keep them from rubbing the finish off the rails underneath. You can buy nice plastic glides, but they leave a gap of almost ⅛" along the drawer bottom, which I don't like.



Instead, I make my own glides from plastic laminate. I cut the laminate into 1"-wide strips, feather the edges on as long a piece as I can handle, then crosscut it into ¾"-wide pieces. These I fasten to the carcass by "rubbing" them with cyanoacrylate or aliphatic resin glue.

Michael Burton, Ogden, Utah

Arrow Points Correct Feed Direction

When you're planing more than one board, trying to keep track of the correct feed direction for both sides of every board can be confusing.

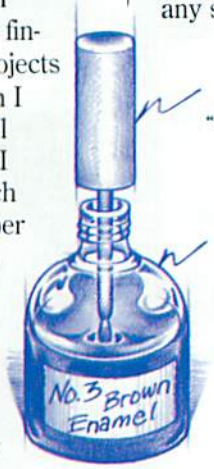
After determining the correct direction of feed (in order to plane with the grain and avoid chipout), I pencil a large arrow on the edge of each board. I mark a tail on the arrow to indicate the surface being planed and an arrowhead to show feed direction.

L. K. Bolay, Oak Harbor, Ohio

Salvaged Bottles Ideal For Storing "Touch-Up" Finishes

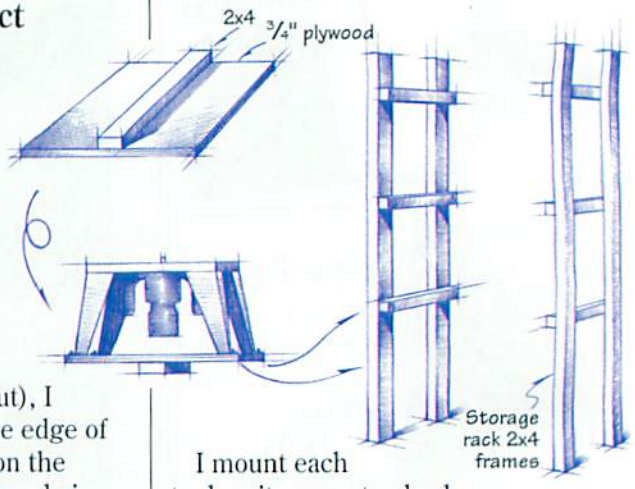
I clean discarded nail polish bottles with lacquer thinner, then fill them with left-over paints or finishes from my various projects and label them. When I need to do a small touch-up job, I simply reach for the proper bottle. Each bottle comes with its own built-in brush, so there's no time spent looking for one or cleaning it after.

Howard Moody, Upper Jay, N.Y.



Vertical Rack Stores Benchtop Power Tools Out of the Way

I own several benchtop-sized power tools but don't have room in my small shop for all of them to be set up at the same time. So, I devised a system that lets me access each one quickly, then easily store it out of the way when it's not being used.



I mount each tool on its own standardized plywood base and attach a 2x4 strip centered along its bottom as shown. When I want to use a tool, I simply place it on my Workmate and clamp the 2x4 strip in its top.

When tools are not in use, I stack them in the vertical rack, which is also made of 2x4s. The cross-braces can be positioned to accept about any size benchtop tool you have.

Steve Tkaczyk, Gaithersburg, Md.

Woodworker's Journal pays $25–$100 for reader-submitted shop tips that are published. Send your ideas (including sketch if necessary) to: *Woodworker's Journal*, News Plaza, P.O. Box 1790, Peoria, IL 61656, Attn: Shop Tips Editor. We redraw all sketches, so they need only be clear and complete. If you would like the material returned, please include a self-addressed stamped envelope.

SHOP TEST

Two New Air-Powered Carvers From PSI

by Jim Barrett

While researching my article on power carvers for the Nov./Dec. 1994 issue of *Woodworker's Journal*, I enlisted the aid of master carver William J. (Bill) Schnute to help me test the various electric carving tools featured in the review. Bill's comments on the different machines certainly enhanced my evaluation, but he was a bit prejudiced. He, like many professional carvers, has switched to air-powered tools to practice his craft.

Bill cited a variety of reasons for making the switch to air power. In a nutshell, air tools run at higher speeds and torque, with less vibration than you get from most electric tools. This translates into more carving power and smoother cuts. Also, the air-driven handpieces tend to be more durable because they have fewer moving parts, and the air hoses they connect to are more flexible than the sheathed flexshafts used with electric carvers. The handpieces on the air-powered tools also tended to be slimmer and better balanced than the units with self-contained motors.

Wildlife carver Bill Schnute tests Penn State's PSI Turbo Carver on his latest creation, "Outfoxed".

My first reaction when I saw Bill's equipment in operation was: "Okay, I'm sold, but where do I get them?" It turns out that his handpieces are in fact small pneumatic die-grinders of the type often used by metalworkers and auto body shops. A number of industrial supply houses sell them —but not cheaply. Prices range from about $200 to $300, $250 being the average price for a decent handpiece. (See Sources at the end of this article.) Recently, though, Penn State Industries (PSI) started marketing two air-driven handpieces targeted at woodcarvers: the PSI Turbo Carver and an air-powered carver kit.

The PSI Turbo-Carver

This pencil-styled handpiece weighs just 4 ounces, yet it provides plenty of speed and power for fast, smooth detail carving in all types of wood. The tool operates at speeds of up to 56,000 rpm at a maximum air pressure of 90 psi, while consuming only 2 cfm of air at top speed. With this low air consumption, you won't need a large air compressor to run it; most 1-hp compressors should do nicely.

The tool comes with ⅛" and 3/32" collets to fit a variety of burrs and bits. It also has an integral, highly flexible air hose (called a "whip") that accepts ¼" NPT fittings and a twist-type variable speed control on the back of the handpiece. The variable speed capability comes in handy if you work with other materials such as metals or plastics.

Several things impressed us when we put the Turbo-Carver through its paces. One was a conspicuous lack of vibration throughout its speed range, which we attributed to the dual ball bearings at the front end. (Most industrial grinders have only one bearing in front and one in the back.) The extra bearing, we felt, eliminated side play (runout) and end play in the shaft. This ensures a true-running bit that stays in the cut during carving, as well as very little or no "buzzing" (vibration) in the handpiece. This feature also bodes well for the tool's life expectancy, since carving exerts a great deal of side thrust on the front end of the tool shaft. We were also hard put to bog the tool down, even when making deep cuts in hardwoods.

The tool does not offer a means of reversing shaft direction. Reversible power carvers are often favored by left-handed users (they direct dust away from the user) and by those who want to achieve a symmetrical look in woods with difficult grain patterns. (The reversing feature enables you to carve with the grain to prevent fuzzing.)

We also liked the permanently attached collet over-guard. This enables you to grip the handpiece closer to the bit for added control. As Bill noted, "The only thing I'd do [to improve the tool] would be to wrap a piece of duct tape around the handpiece, or slip a piece of plastic tubing over it, to provide more grip." He also observed that the high volume of air rushing through pneumatic tools sometimes makes the metal handpiece uncomfortably cold to the touch, unlike motorized tools, which tend to heat up during operation. The tape or tubing, Bill adds, would also provide some thermal insulation.

Continued on page 21

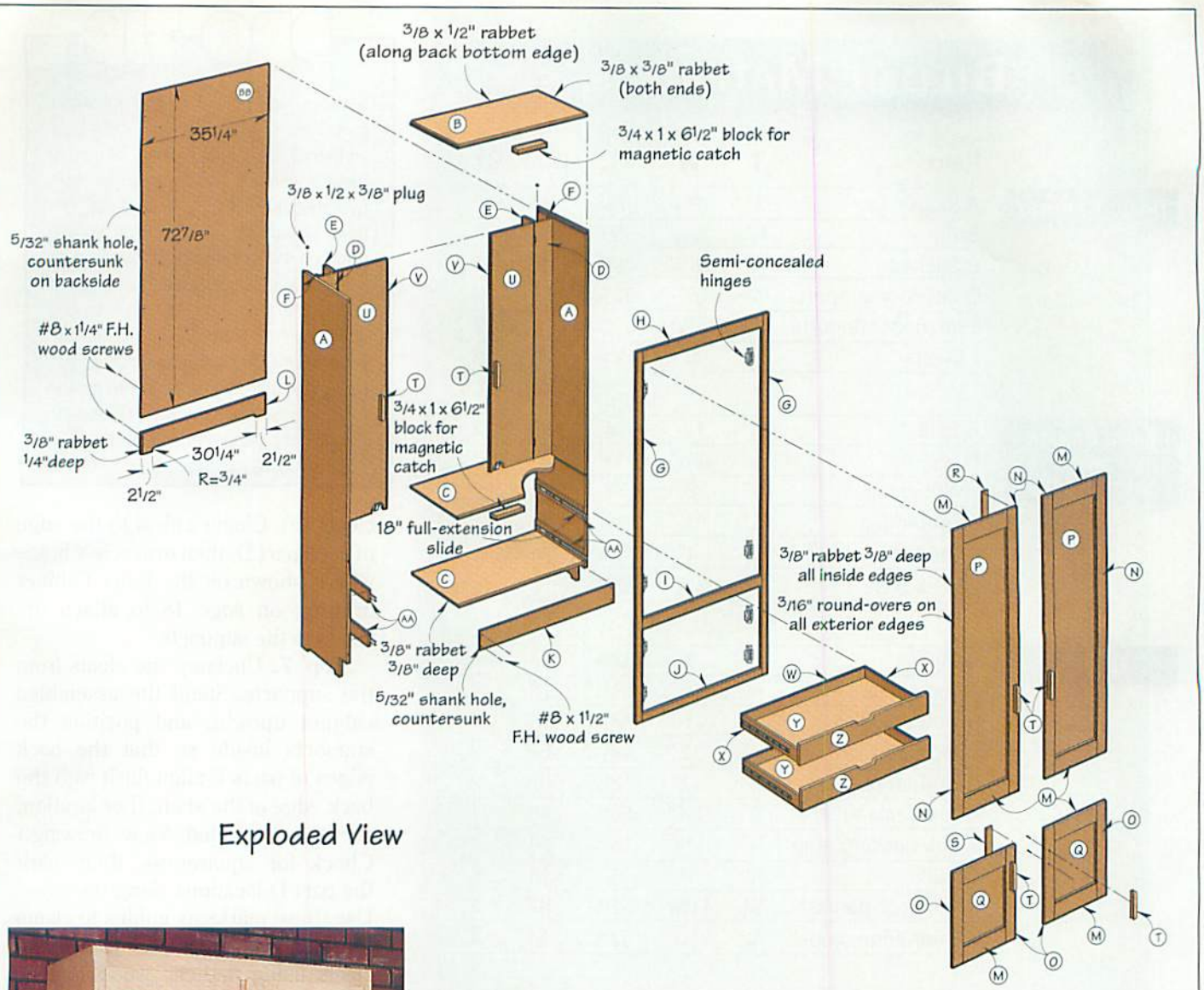
A Cabinet That Conquers Shop Chaos

A Place For Everything

We recently visited Bob Colpetzer, a frequent contributor who lives atop a wooded knoll in eastern Tennessee. The first thing Bob did when he retired there a few years back was build himself a 40x40-foot shop, which he then fitted with some well-considered designs and custom features.

This cabinet—along with several dozen other appointments—impressed us with its no-frills logic and aggravation-saving convenience. Bob simply wanted enough capacity to organize his most frequently used hand tools and small power tools in a single, dust-free, ready-to-hand locale. (We figured that this guy, if anybody, ought to know how to prevail over shop chaos, having taught high-school industrial arts for 25 years in the Chicago, Illinois area.)

Next issue, we'll offer 14 of Bob's equally practical rack and holder designs, which will handle just about any tool you might want to store in your new cabinet.



Exploded View

Build the Basic Cabinet

Step 1. From ¾"-thick plywood, cut the sides (A), top (B), and shelves (C) to the dimensions listed in the Bill of Materials. (We used furniture-grade birch plywood. For our thoughts on cutting out these and the rest of the plywood parts, see the Pro Tip on *page 16.*)

Step 2. Cut dadoes across the inside face of both sides where shown and dimensioned on the Cabinet Side drawing on *page 17.* Using this same setup, cut a rabbet (to form a tongue) along both ends of the top (top face) and each shelf (bottom face) where shown on the Exploded View drawing. Note: Depending on the true thickness of your plywood, you may need to adjust the blade height to ensure that the tongues will fit in the dadoes. Now, cut a rabbet along the back edge of the inside face of the sides and bottom edge of the top to accept the back panel. Note: You'll rabbet the back edge of the top along the bottom face, whereas you rabbeted the top face along the ends.

Step 3. Notch the bottom front corner of each side where dimensioned on the Cabinet Side drawing. Next, lay out and cut the profile along the bottom end of the sides. (We used our portable jigsaw with a plywood blade for both operations.)

Step 4. Arrange a large work surface, and check to verify that it's flat and level. (We used a pair of sawhorses.) Next, dry-assemble the cabinet (sides, top, and shelves) to make sure that everything fits. Make any necessary adjustments, then glue and clamp the assembly. (We used several homemade right-angle forms

Bill of Materials

	Part	T	W	L	Mat.	Qty.
Basic Cabinet	A Sides	¾"	19¼"	78"	BP	2
	B Top	¾"	19¼"	35¼"	BP	1
	C Shelves	¾"	18¾"	35¼"	BP	2
	D Int. door supports	¾"	5"	52¾"	M	2
	E Int. door supports	¾"	4⅝"	52¾"	M	2
	F Cleats	¾"	¾"	52¾"	M	2
Face Frame and Base Parts	G Stiles*	¾"	1½"	74"	M	2
	H Top rail	¾"	2½"	33"	M	1
	I Middle rail	¾"	2"	33"	M	1
	J Bottom rail	¾"	1½"	33"	M	1
	K Toe kick	¾"	4"	36¼"	M	1
	L Back base	¾"	4¾"	35¼"	M	1
Doors	M Rails	¾"	3"	12⅛"	M	8
	N Top stiles	¾"	2½"	51½"	M	4
	O Bottom stiles	¾"	2½"	17½"	M	4
	P Top panels	½"	12"	46¼"	BP	2
	Q Bottom panels	½"	12"	12¼"	BP	2
	R Top backing strip	⅜"	1⅜"	50½"	M	1
	S Bot. backing strip	⅜"	1⅜"	16¾"	M	1
	T Pulls	¾"	1"	5"	M	6
	U Int. door panels*	¾"	11⁹⁄₁₆"	52½"	BP	2
	V Door edge strips*	⁵⁄₁₆"	¾"	52½"	M	4
Drawers	W Fronts/backs	½"	2½"	31½"	P	4
	X Sides	½"	2½"	18"	P	4
	Y Bottoms*	½"	17½"	31½"	BP	2
	Z False fronts	¾"	4"	32¾"	M	2
	AA Slide build-ups	¾"	2½"	18¾"	M	4
	BB Back*	½"	35¼"	72⅞"	BP	1

*Cut part oversized initially, then cut to size during construction. Please read all instructions before cutting.

Materials List

BP–birch plywood
M–soft maple
P–poplar

Supplies

#6x1¼", #8x1¼", #8x1½" flathead wood screws
Water-based acrylic or polyurethane finish

(Note: For hardware supplies, see Sources list on page 21.)

PRO TIP

When you cut out your plywood parts, you'll want to keep in mind both economy and appearance. If you're careful, you can make all parts from two sheets each of ¾"-thick and ½"-thick plywood and still match up the grain on the three pairs of doors. To do this, cut one side (A), the top (B), and both interior door panels (U) from one sheet of ¾". From the other, cut the other side (A) and the two shelves (C). Use your first sheet of ½" ply for the four exterior door panels (P, Q) and the two drawer bottoms (Y). Cut the cabinet back (BB) from the other ½" sheet.

to help square our cabinet.) Check for squareness and flatness, then allow the glue to dry.

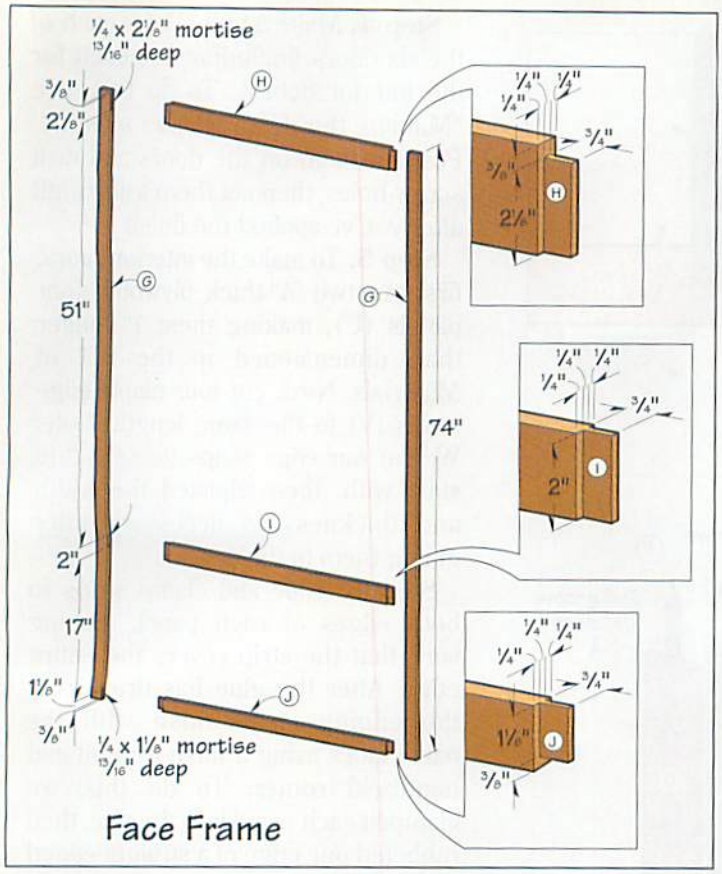
Step 5. To make the interior door supports, first cut the four interior posts (D, E) to the dimensions listed in the Bill of Materials. (We used soft maple.) Next, cut a groove along one edge of both parts D and a mating rabbet along one edge of both parts E. (For dimensions, see the Interior Door and Support drawing on *page 18*.)

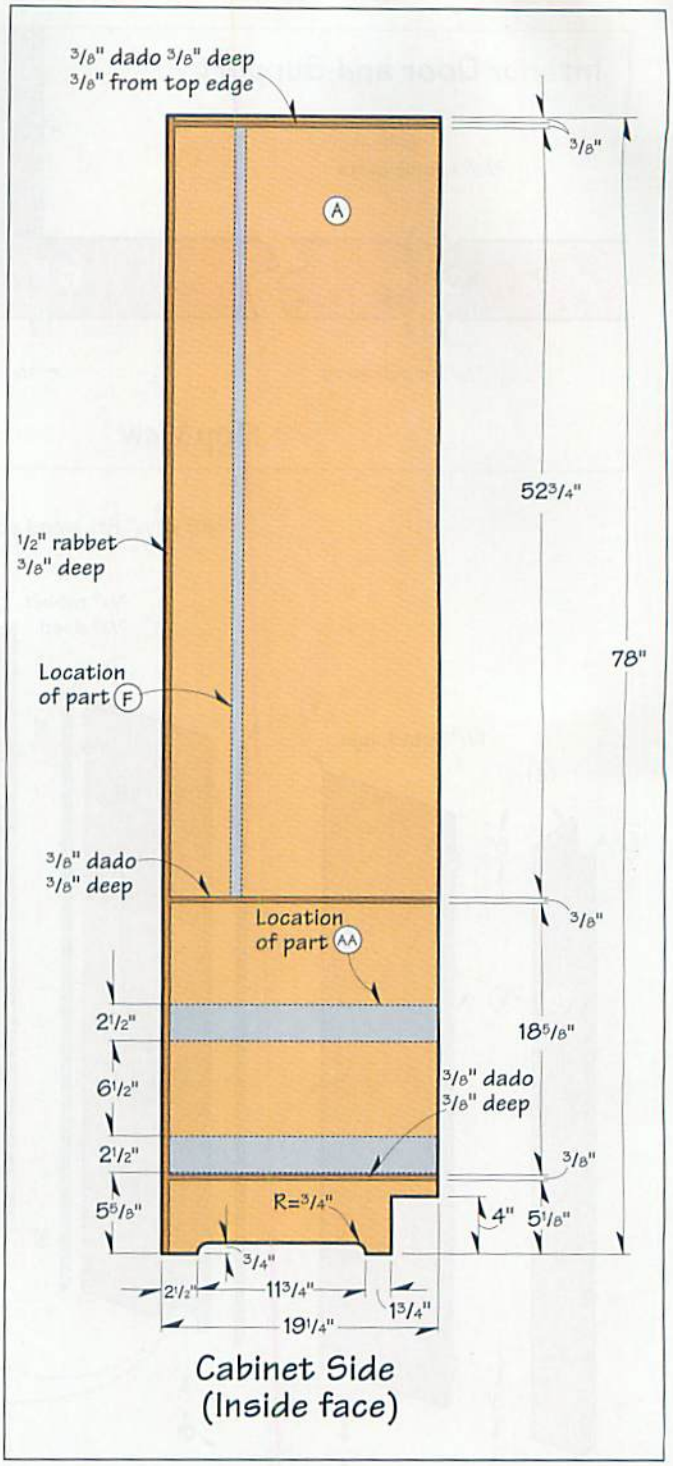
Step 6. Glue and clamp one part D to each part E, using right-angle forms to ensure squareness. While the glue dries, cut a pair of support cleats (F). Clamp a cleat to the edge of each part D, then drill screw holes where shown on the Inner Cabinet drawing on *page 18* to attach the cleats to the supports.

Step 7. Unclamp the cleats from the supports. Stand the assembled cabinet upright, and position the supports inside so that the back edges of parts E align flush with the back edge of the shelf. (For location, see the Exploded View drawing.) Check for squareness, then mark the part D locations along the sides. Use these marks as guides to clamp the cleats to the sides. Attach the cleats using flathead wood screws, then screw the supports to the cleats. Now, drill two holes down through the top and two holes up through the shelf into each support, then drive the screws.

Add the Face Frame and Base Parts

Step 1. Rip and crosscut two face frame stiles (G) and a top, a middle, and a bottom rail (H, I, J). (We used soft maple.) Next, lay out and cut mortises in each stile where shown and dimensioned on the Face Frame drawing *opposite*. We used our hollow-chisel mortiser, clamping the end of each workpiece *to a fence* and supporting the other end. You can also rough out the mortises on your drill press and then square them with a chisel. Next, cut tenons on the ends of each rail as dimensioned on the details that accompany the drawing. (We cut the shoulders





on the tablesaw, then bandsawed the cheeks to width.)

Step 2. Dry-assemble the face frame (G, H, I, J), and position it on the cabinet to check for fit and alignment. Note: The frame, as dimensioned, should overhang 1/16" on both sides; you'll trim these edges flush with the cabinet sides after assembly in Step 5. Adjust any parts that need it, then remove the frame from the cabinet. Now, glue and clamp the face frame. Check for squareness and flatness.

Step 3. While the glue dries, measure the actual width of the cabinet, then rip and crosscut the toe kick (K) and back base (L) to size. Cut a ⅜"-wide rabbet ¼" deep along both ends of the back base (inside face). Then, lay out and bandsaw the cutout along the bottom edge where dimensioned on the Exploded View drawing. Finish-sand both parts, then clamp them to the cabinet and drill countersunk screw holes. Attach each part to the cabinet using flathead wood screws.

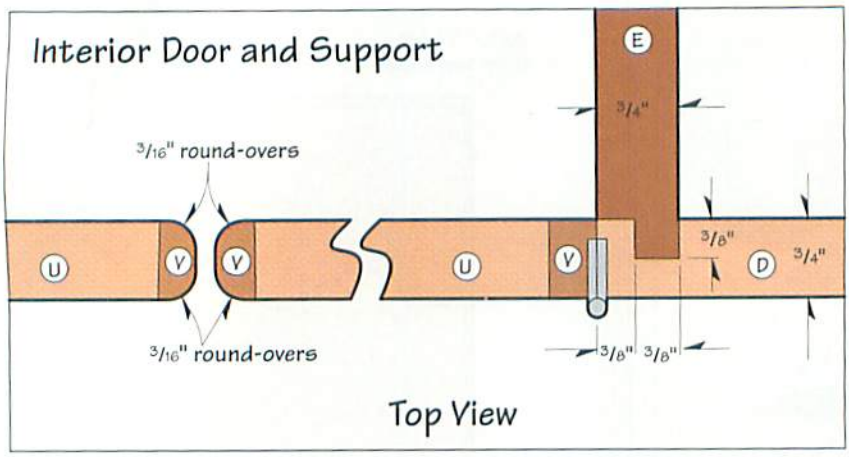
Step 4. Unclamp the face frame, then finish-sand it. Now, glue the frame to the cabinet. Check to make sure it's square to the carcass, then clamp. Wipe away squeeze-out where possible, and allow the glue to dry.

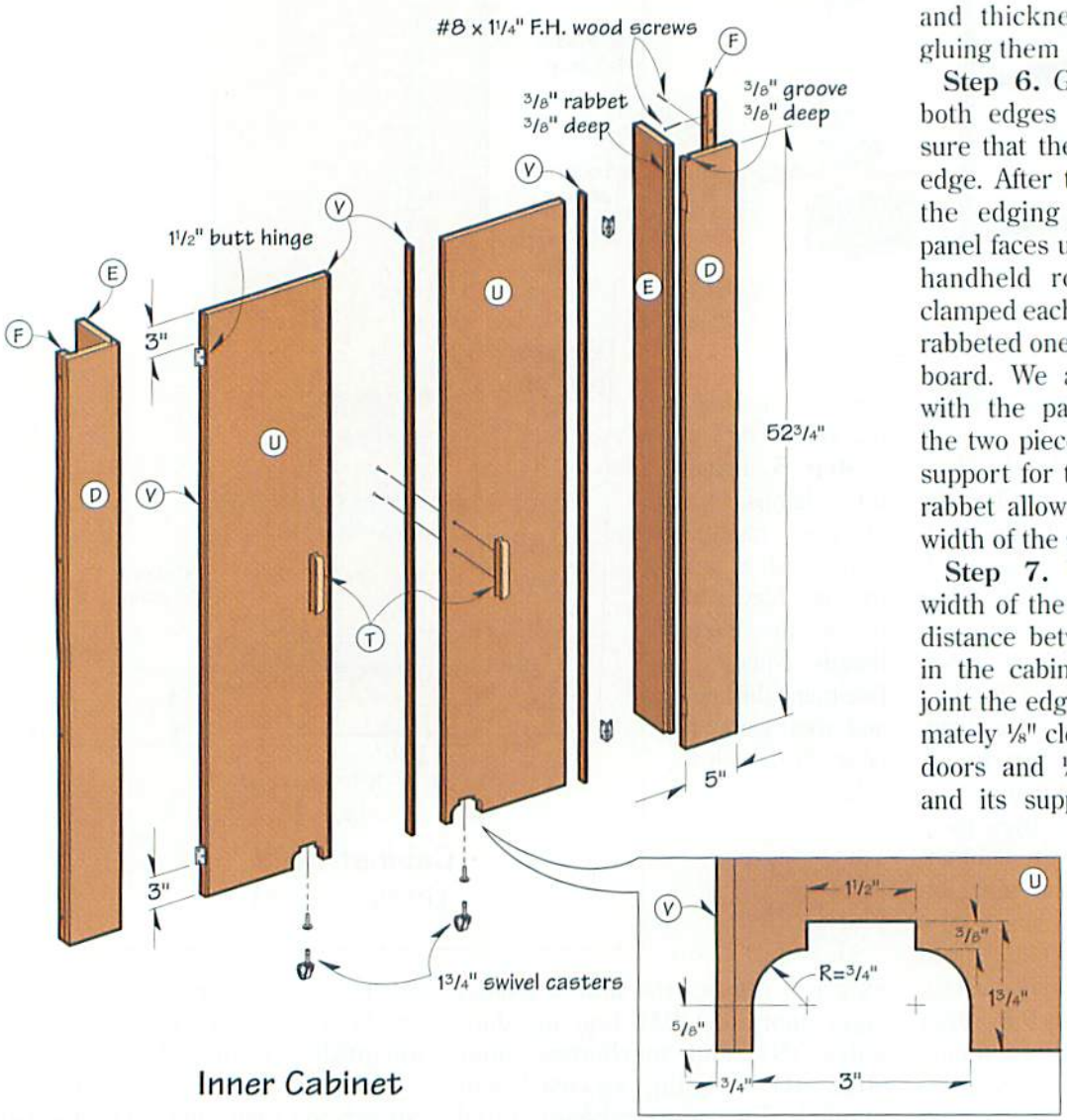
Step 5. Remove the clamps, then fit your handheld router with a flush-trim bit. Elevate the bit so the cutting length equals the face-frame thickness, and rout the frame edges flush with the cabinet sides.

Next, Make the Doors

Step 1. For the exterior doors, rip and crosscut eight door rails (M), four top door stiles (N), and fourbottom door stiles (O). (Again, we used soft maple.) Fit your table-mounted router with the tongue-cutting bit of a stile and rail bit set. (We used Freud catalog no. 99-260.) Next, rout both ends of all eight door rails. (We used a backing board and a zero-clearance fence and routed all door parts facedown so that any thickness variation would show on the inside.) Switch to the groove-cutting bit, and set it to cut the groove ¼" up from the bottom face of the stock. Rout the inside edge of each stile and rail.

Step 2. From ½"-thick plywood, cut two top door panels (P) and two bottom door panels (Q) to size. Measure the actual dimensions of the stile and rail grooves, then rabbet the back edges of the panels to create a tongue that will fit the grooves. Next, dry-assemble each of the four doors, checking for fit and squareness. Adjust if necessary, then glue, assemble, and clamp the four door





frames, allowing the panels to float in the grooves without glue. Again, check for squareness and flatness.

Step 3. Using a 3/8" dado head and zero-clearance auxiliary fence, rabbet the back edges of each door. Next, fit your table-mounted router with a 3/16" round-over bit and fence, and rout all four front edges. Now, rip enough 3/8x1 3/8" maple stock to make backing strips (R, S) for the top and bottom left-hand doors. Trim the strips to match the length of the rabbeted edge on the back of each door. Sand the pieces smooth, then glue and clamp them into the rabbeted recess along the inside edge of the two left doors.

Step 4. Make a pull (T) for each of the six doors (including one each for the interior doors). To do this, see "Making the Door Pulls" *opposite.* Position them on the doors and drill screw holes, then set them aside until after you've applied the finish.

Step 5. To make the interior doors, first cut two 3/4"-thick plywood door panels (U), making them 1" longer than dimensioned in the Bill of Materials. Next, cut four maple edge strips (V) to the same length. Note: We cut our edge strips to 1/2x1 3/16" to start with, then adjusted the width and thickness as necessary after gluing them to the doors.

Step 6. Glue and clamp strips to both edges of each panel, making sure that the strip covers the entire edge. After the glue has dried, rout the edging strips flush with the panel faces using a flush-trim bit and handheld router. To do this, we clamped each panel into the vise, then rabbeted one edge of a straight-edged board. We aligned this edge flush with the panel edge and clamped the two pieces. (The board provided support for the router base, and the rabbet allowed room for the excess width of the strip.)

Step 7. Measure the combined width of the two doors and then the distance between the door supports in the cabinet. If necessary, rip or joint the edge strips to allow approximately 1/8" clearance between the two doors and 1/16" between each door and its support. Next, round over both edges of the inside edge strips as dimensioned on the Interior Door and Support drawing. Now, measure the height of the cabinet interior, and trim the doors to length. (We allowed 1/8" clearance at top and bottom.)

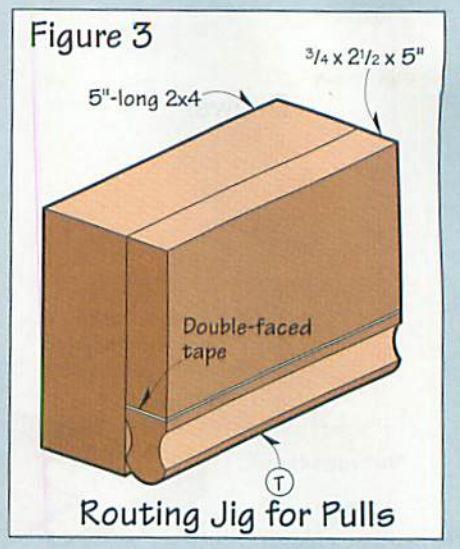
Step 8. Lay out and jigsaw the cutouts for the casters where dimensioned on the detail shown with the Inner Cabinet drawing. Note: The detail specifies dimensions that fit the casters listed in the Sources. If you use other casters, adjust the dimensions accordingly. Next, drill a hole

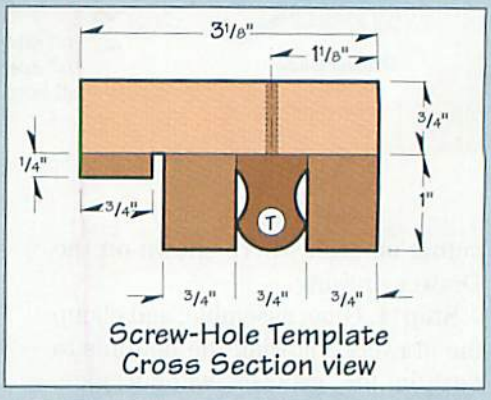
Making the Door Pulls

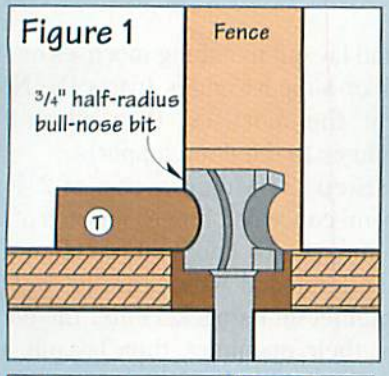
To machine the six door pulls (T), first cut a maple blank to ¾x2x36". Fit your table-mounted router with a ¾" (cutting height) half-radius bull-nose bit, and rout one edge of the blank *(figure 1)*. Sand the bull-nose smooth, then switch to a ¾" core-box bit and elevate it ⅛" above the table surface. Clamp a fence to the table 9/16" from the center of the bit *(figure 2)*, and rout both faces of the blank. Next, sand both core-box grooves, and then rip the blank to 1" finished width. Now, crosscut six 5"-long pulls from the blank.

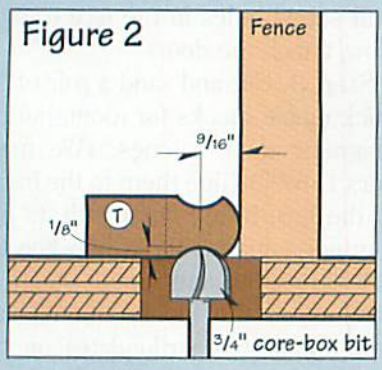
To round the pull ends, first cut a 5" length of 2x4 for a carrier board *(figure 3)*. Using one of the pulls as a guide, nail a 2½x5" piece of ¾"-thick stock to one face, creating a niche exactly the same width as the pull. Adhere the flat edge of a pull to the edge of this piece using double-faced carpet tape. Using your table-mounted router and a piloted ¾" round-over bit, rout both ends of the pull. If you don't have a bit this large, a ⅝" or ½" bit will suffice. Once you've routed the ends on all six pulls, sand them smooth.

Drill two 3/32" pilot holes (for #6x1¼" flathead wood screws) into the flat edge of each pull 1¼" from each end. We made a template as shown *(figure 4)* to keep the holes uniform both in the pulls and in the cabinet. Later, after you've finished the doors and pulls, use the template to drill centered shank holes 2½" apart through each inside door stile. Then mount the pulls.









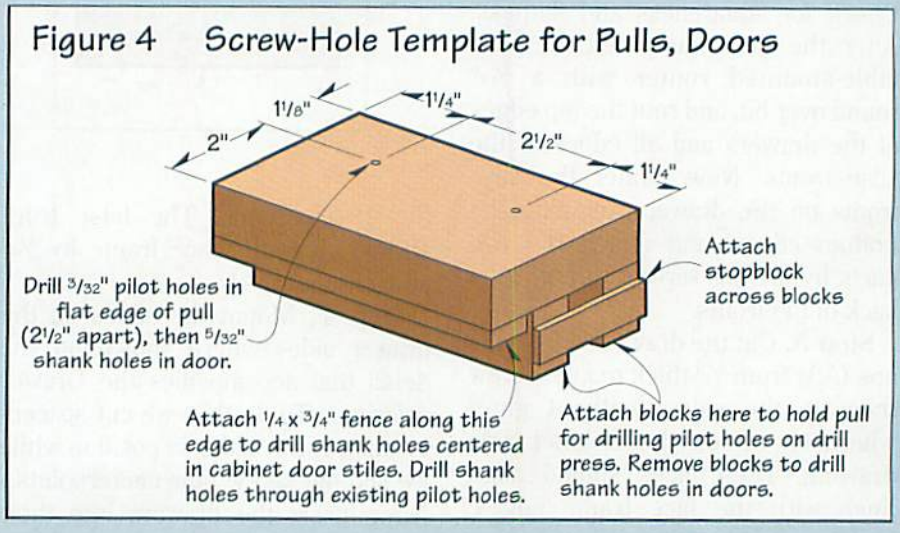


Figure 4 Screw-Hole Template for Pulls, Doors
1⅛"
1¼"
2"
2½"
1¼"
Drill 3/32" pilot holes in flat edge of pull (2½" apart), then 5/32" shank holes in door.
Attach stopblock across blocks
Attach ¼ x ¾" fence along this edge to drill shank holes centered in cabinet door stiles. Drill shank holes through existing pilot holes.
Attach blocks here to hold pull for drilling pilot holes on drill press. Remove blocks to drill shank holes in doors.

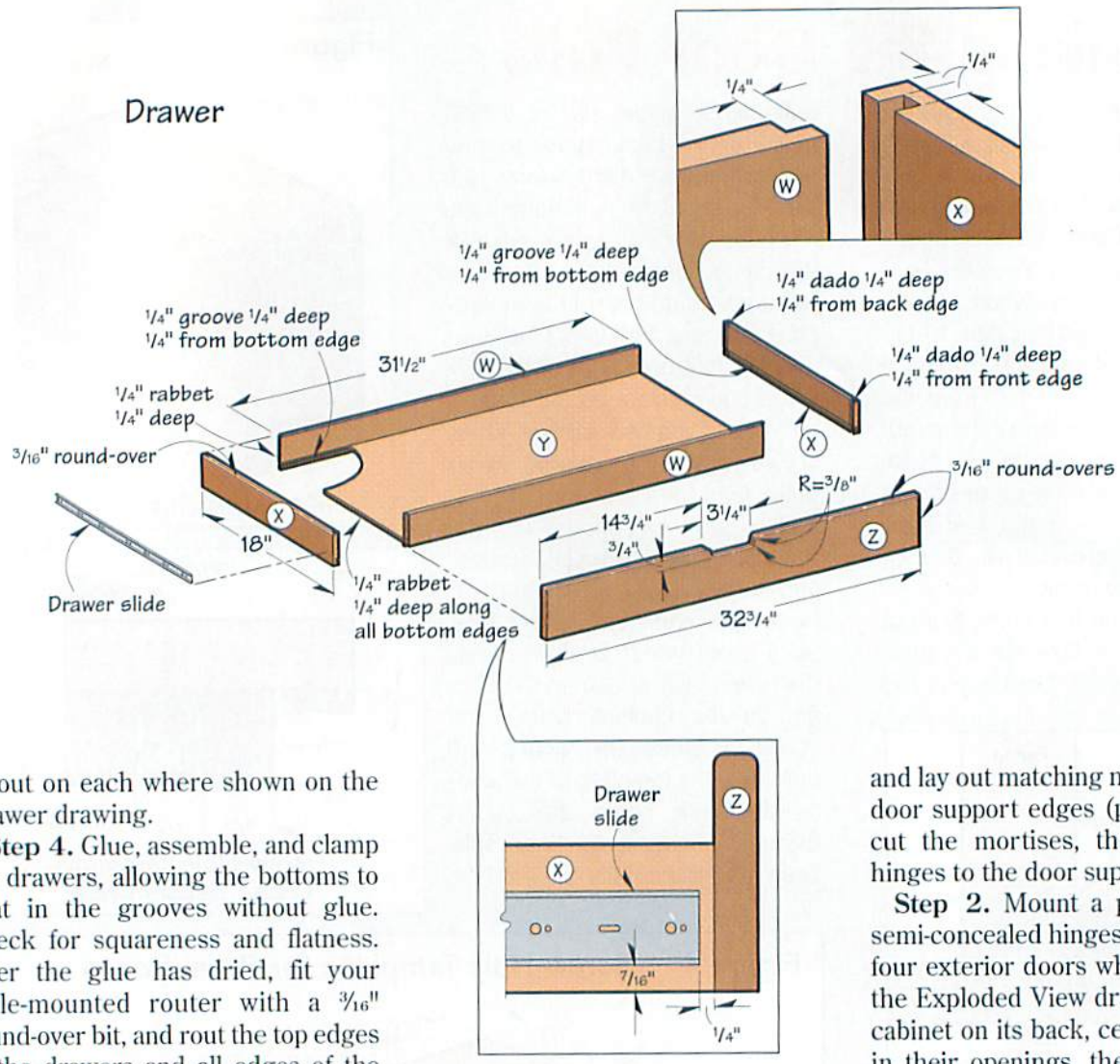
for the caster insert in each door. Now, install the casters. (To order the casters and other hardware, see the Sources list on *page 21*.)

Now, Build and Install the Cabinet Drawers

Step 1. From ½"-thick stock, rip and crosscut two drawer fronts (W), two backs (W), and four sides (X) to size. (We selected poplar.) Next, rabbet the ends of the fronts and backs where dimensioned on the detail that accompanies the Drawer drawing on *page 20*. Then, cut mating dadoes on the ends of each side. Now, cut a groove of the same dimensions along the bottom edge of the fronts, backs, and sides.

Step 2. Dry-assemble the two drawers to check for fit. At the same time, measure the inside dimensions and add ½" for the grooves. Then, cut two bottom panels (Y) to fit from ½"-thick plywood. Using a ¼" dado head and a zero-clearance wooden auxiliary fence, cut a ¼"-deep rabbet along all four edges of the bottom face of each bottom panel.

Step 3. From ¾"-thick maple stock, rip and crosscut two false fronts (Z). Lay out and bandsaw the



cutout on each where shown on the Drawer drawing.

Step 4. Glue, assemble, and clamp the drawers, allowing the bottoms to float in the grooves without glue. Check for squareness and flatness. After the glue has dried, fit your table-mounted router with a 3/16" round-over bit, and rout the top edges of the drawers and all edges of the false fronts. Now, center the false fronts on the drawers, aligning the bottom edges, and attach the two parts by driving screws through the back of the fronts.

Step 5. Cut the drawer slide build-ups (AA) from 3/4"-thick maple. Screw them to the sides (without glue) where shown on the Cabinet Side drawing. Their faces should align flush with the face frame edges. Next, mount 18" full-extension drawer slides on the build-ups 1" back from the face frame. (To purchase the slides and other hardware, see the Sources list *opposite*.) Position the slides for the lower drawer 1/8" up from the bottom shelf.

Step 6. Check the overall width of the drawers, which should be 1" narrower than the distance between the build-ups. If necessary, remove the false fronts, and trim a bit of thickness from the sides to achieve the 1" clearance. The false front should clear the face frame by 1/8" at each end.

Step 7. Mount the slides on the drawer sides where shown on the detail that accompanies the Drawer drawing. (To do this, we cut spacers to support the slides in position while we laid out screw hole centerpoints.) Now, insert the drawers into their slides, check the action, and make any necessary adjustments.

Hang the Doors and Add Finishing Touches

Step 1. Lay out and cut hinge mortises in the outside edges of the interior doors where shown on the Inner Cabinet drawing. Then, mount the hinges in the mortises. Position the interior doors in their opening with the casters supporting their weight, and lay out matching mortises on the door support edges (parts D). Now, cut the mortises, then attach the hinges to the door supports.

Step 2. Mount a pair of 2"-long semi-concealed hinges on each of the four exterior doors where shown on the Exploded View drawing. Lay the cabinet on its back, center the doors in their openings, then lay out and drill screw holes in the face frames. Now, attach the doors.

Step 3. Cut and sand a pair of 3/4"-thick maple blocks for mounting the magnetic door catches. (We made ours 1x6½".) Glue them to the inside of the face frame flush with its bottom edge and centered between the stiles. Position and mount magnetic catches on the blocks, then locate and mount the strikeplates on the backs of the doors. Now, attach the catches for the interior doors directly to the underside of the top, and mount the strikeplates on the doors.

Step 4. Measure the holes in the top back corners of the cabinet. (These were created by the intersection of the rabbet for the back panel and the groove for the top.) Cut hardwood plugs to fit, and glue them into the holes. Now, measure the rabbeted recess on the back of the cabinet, and cut a back panel (BB) to fit from

½"-thick plywood. Temporarily install the back in its recess, then lay out and drill countersunk screw holes to attach the back to the door supports (parts E) and the bottom shelf (C).

Step 5. Remove the doors, hinges, drawers, and slides. Finish-sand all surfaces that require it, then apply finish. (We brushed on a coat of Minwax Polycrylic Clear Satin as a sanding sealer, allowed it to dry, and sanded lightly with 220-grit sandpaper. We then applied two additional coats, rubbing each coat with 0000 synthetic steel wool.)

Step 6. After the final finish coat has dried overnight, reattach the hardware, doors, and drawers. Then, attach the back panel.

Photograph: Kevin May

Sources

Hardware. 18" full-extension drawer slides, 100-lb. load rating. Catalog no. 32490, $15.45/pr. Casters, white styrene, 1⅝"-dia. wheels, 2⅛" height, 60-lb. load rating. Catalog no. 24026, $3.75/pr. Semi-concealed hinges, 2" long, ⅜" inset, free-swinging, polished brass. Catalog no. 26997, $3.35/pr. Butt hinges, 1½x1¼", polished brass. Catalog no. 25759, $2.45/pr. Narrow magnetic catch with strikeplate, tan, ½x¾x1⅞". Catalog no. 26559, $.95/ea. Add $4.95 shipping/handling (orders up to $20.00), $5.95 (up to $40.00), $6.95 (up to $60.00).

Complete Hardware Kit. Includes each of the above: drawer slides (2 pr.), casters (1 pr.), semi-concealed hinges (4 pr.), butt hinges (2 pr.), magnetic catches (6). Order kit no. 62604, $54.95 ppd. Order from:

The Woodworker's Store
21801 Industrial Blvd.
Rogers, MN 55374-9514
Telephone: 800/279-4441

SHOP TEST

Continued from page13

The Turbo-Carver performed every bit as well as its $250-plus industrial-grade counterparts. "For the price, you can't beat it," Bill concludes.

The Air-Power Carver Kit

This kit includes a handpiece with three collets (¼", ⅛", and 3⁄32"), two collet wrenches, and 10 assorted stones in a plastic case. The handpiece operates at speeds of up to 20,000 rpm at 50-90 psi, with a maximum air consumption of 4 cfm. (Actual speed varies with airflow.) The handpiece has a ¼" NPT air inlet (female threads), to which you attach a quick-disconnect fitting (available at air-tool suppliers).

Carver in the Air-Power Carver Kit performs comparably to many of the electric carving units available.

Like its industrial-type counterparts, the tool has a front air exhaust to blow dust away from the workpiece and a palm-operated variable speed control lever. It does not reverse. The tool had plenty of speed and power for general carving—more than you'd get with most electric flex-shaft tools. However, the handpiece lacked the precision, weight, and overall quality of construction typical of most industrial-grade die grinders. Our test unit had some end and side shaft play, which produced more vibration and a bit more runout than the air tools Bill works with.

The kit is promoted as a carving setup, but the stones that come with it are better for grinding metal than for carving wood. Operated at high speeds, they clogged quickly and burned the wood. You'll want to buy extra carving bits and burrs for the unit, which Penn State does offer in their catalog.

Bill and I agreed that the PSI Air-Power Carver Kit would make a good "first tool" for beginning or occasional carvers operating on a tight budget. It compares favorably with the Foredom-type electric flex-shaft tools in power, ease of use, and low maintenance requirements. The three collets expand the tool's versatility to applications beyond woodcarving—grinding, polishing, etching, and more.

Photographs: Jim Barrett

Sources

PSI Turbo-Carver (catalog item TURBO) $129.95; PSI Air Power Carver Kit (catalog item APC) $39.95. Available from:

Penn State Industries
2850 Comly Road
Philadelphia, PA 19154
Telephone: 800/377-7297.
Pneumatic die grinders (not tested)

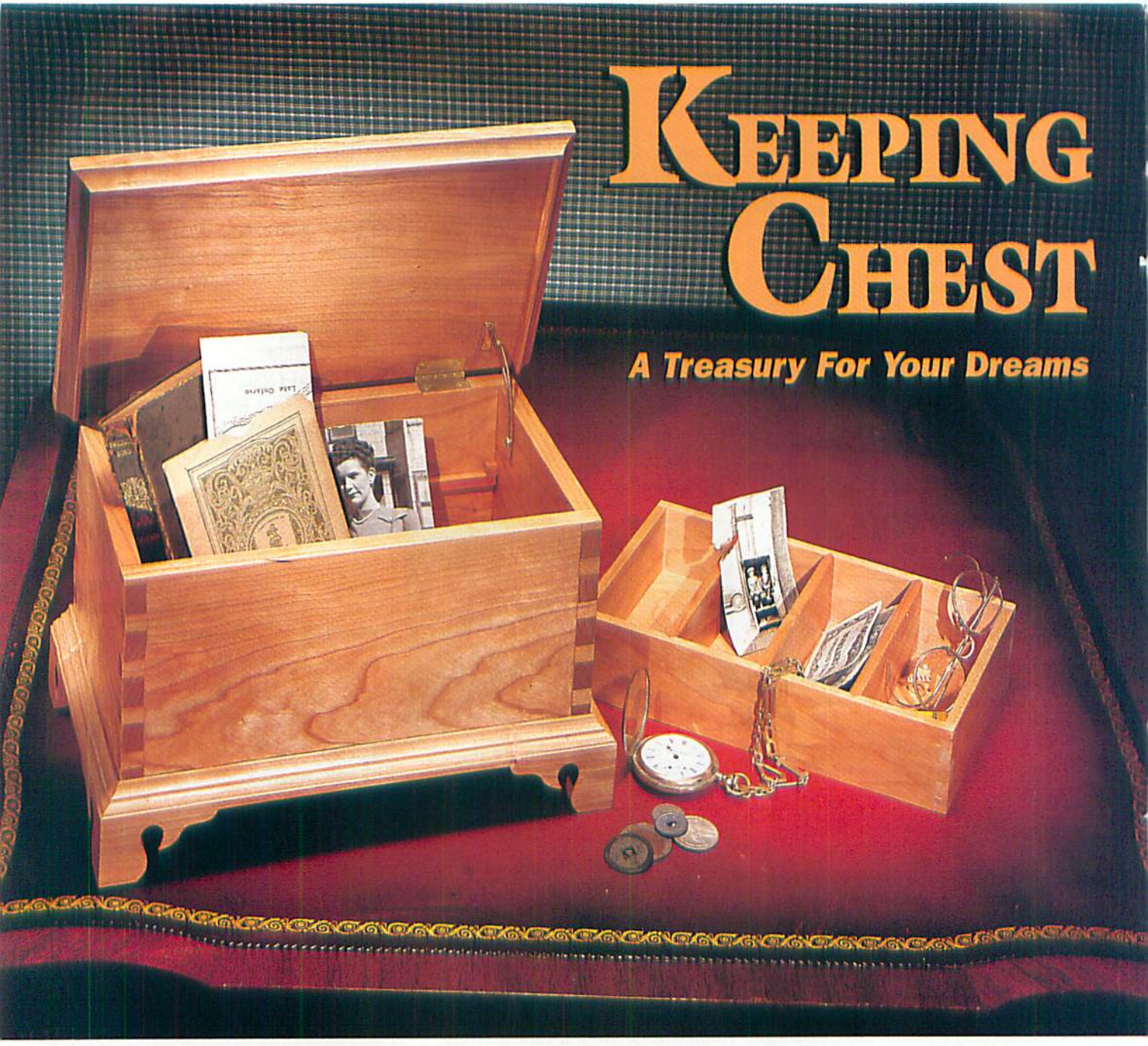
Dotco (Subsidiary of Cooper Air Tools)
P.O. Box 182
Hicksville, OH 43526
Telephone: 419/542-7711
(Ask for Dotco Air Tool Catalog)

Master Power
909 Baltimore Blvd.
Westminster, MD 21157
Telephone: 301/876-0076

For other sources, look in the Yellow Pages of your telephone book under Tools, Pneumatic.

KEEPING CHEST

A Treasury For Your Dreams



The American colonists kept their correspondence, their financial records, even their legal documents in variously dimensioned cases of this loosely Chippendale style. (Would that we could still keep all our affairs in such trim little compartments!)

A mini-warehouse might suffice for the average citizen's paperwork these days. But just about everyone still has need of a small, portable chest, either for organizing cross-stitch materials or collectors' supplies or just hoarding all those exotic coins your dad brought back from overseas.

In his design, Bob Dillon of Hackensack, Minnesota, specified hand-cut dovetails that feature distinctively wide tails and narrow pins. Although we opted to use our "through" dovetailing jig (presented in the May/June '94 Woodworker's Journal*), which creates tails and pins of more uniform width, we've honored Bob's original specs by including optional dimensions for his hand-cut dovetails. (See the Hand-Cut Dovetail Layout drawing* opposite *for details. To read more about Bob, see "Meet the Designer" on* page 26.*)*

Dovetail and Assemble the Basic Box

Step 1. Select and prepare stock for the lid (A) and bottom (B). (We started with two ¾x7¾x11½" cherry blanks. To minimize warpage, we ripped each into three pieces, then edge-joined the pieces to form two laminated panels.)

Step 2. Select stock for the front and back (C) and sides (D), then plane this stock, along with the lid and bottom laminations, to ½" finished thickness. Next, rip and crosscut the front, back, and sides to the dimensions listed in the Bill of Materials at *right*.

Step 3. Lay out and cut "through" tails in the ends of the sides and mating pins in the ends of the front and back. (Even though we machine-cut our joints, we still scribed shoulder lines with a marking gauge to enhance the appearance of our chest.) If you prefer to rout the pins and tails, see the template shown in *figure 1* for the dimensions we get using the jig.) Be sure to position the jig template to create sufficiently wide partial pins (at the edges) to ensure that they won't be flimsy or unsightly. If you prefer to hand-cut these joints, lay out the pins and tails as dimensioned in *figure 2*. Note: For detailed help and advice on hand-cutting dovetails, see Roger Holmes' article in the Nov./Dec. '94 *Woodworker's Journal*.

Step 4. Fit your tablesaw with a ¼" dado head, and cut a ¼"-deep groove into the inside face ¼" from the bottom edge of the front, back, and sides to accommodate the bottom. Then, finish-sand the inside faces of these parts.

Step 5. Using a marking gauge, scribe a line (to position the tray supports) along the inside faces of the front and back 2⅜16" from the top edge.

Step 6. Cut 28" of ¼x¼" stock for the two tray supports (E) and for other parts that will be added later. Measure the distance from one set of tail sockets to the other, then subtract ⅛" to establish the length of the supports. Trim the supports to length, then glue, center, and clamp them to the front and back along the bottom side of the scribed lines. Note: Save the cutoffs from the supports to make "mousehole" plugs and corner reinforcements for the base.

Step 7. Cut the bottom (B) to finished dimensions. Next, fit your tablesaw with a ⅜" dado head, and attach a wooden auxiliary fence to your rip fence. "Bury" the dado head in the fence to a depth of 1/16", leaving 5/16" of the head exposed. Then, cut a ¼"-deep, 5/16"-wide rabbet along the bottom edges of the bottom. Test-fit the resulting tongues in the grooved parts, adjust if necessary, and then finish-sand both faces of the bottom.

Step 8. Glue, assemble, and clamp the front, back, sides, and bottom, allowing the bottom to float in its groove without glue. After the glue has dried, cut ½"-long pieces of your tray support cutoffs, and glue

Bill of Materials

Lid And Box

Part	T	W	L	Mat.	Qty.
A Lid*	½"	6 13/16"	10 13/16"	C	1
B Bottom*	½"	6 13/16"	10 13/16"	C	1
C Front/Back	½"	5¼"	10¾"	C	2
D Sides	½"	5¼"	6¾"	C	2
E Tray supports	¼"	¼"	9 11/16"	C	2
F Base front**	½"	2⅛"	11¾"	C	1
G Base sides**	½"	2⅛"	7¼"	C	2
H Base supports	½"	1½"	2¼"	C	2
I Front lid molding**	½"	¾"	12 15/16"	C	1
J Side moldings**	½"	¾"	7 9/16"	C	2

Tray

K Sides	¼"	2⅛"	5 11/16"	C	2
L Front/back	¼"	2⅛"	9¼"	C	2
M Bottom	¼"	5 7/16"	9⅛"	C	1
N Dividers**	¼"	1⅝"	5 7/16"	C	3

*Parts glued up from narrow stock.
**Parts cut to final length during construction.
Please read all instructions before cutting.

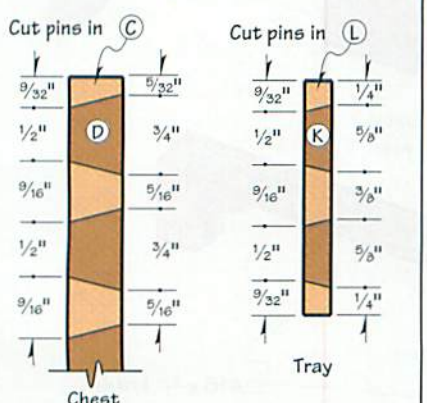
Materials List

C–cherry

Supplies

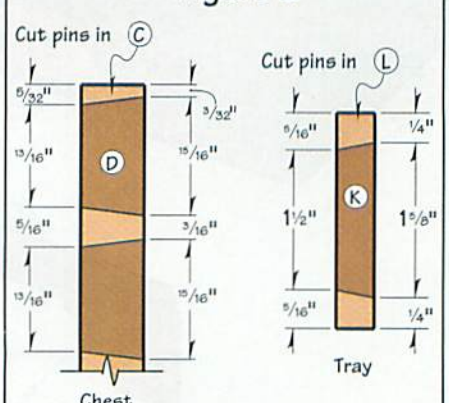
2–1¼ x 1 1/16" brass butt hinges; small right-hand, brass-finish lid support

Figure 1

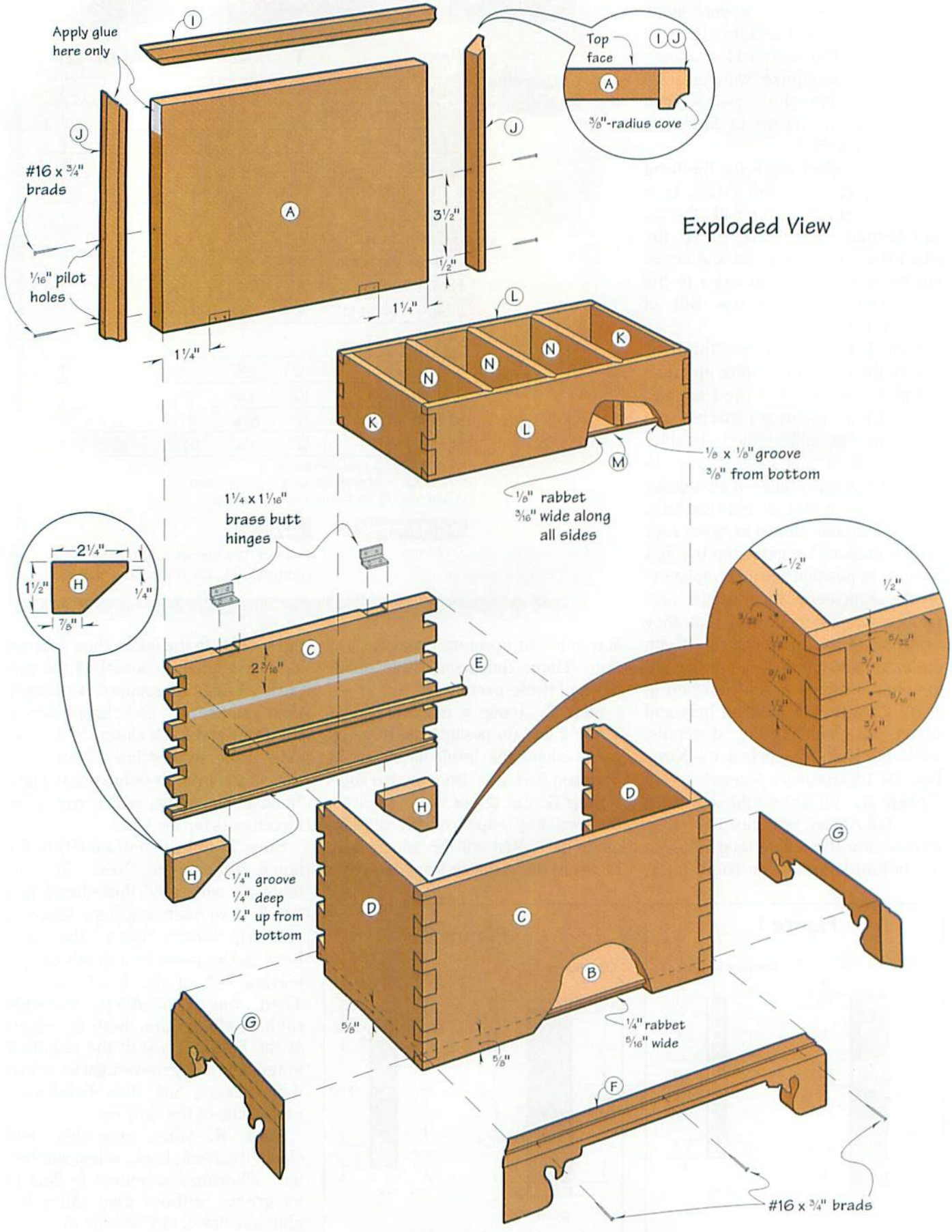


Jig-Cut Dovetail Layout

Figure 2



Hand-Cut Dovetail Layout


Exploded View
Apply glue here only
I
J
#16 x ¾" brads
1/16" pilot holes
A
3½"
½"
1¼"
1¼"
Top face
I J
A
⅜"-radius cove
L
K
N
N
N
K
L
M
⅛ x ⅛" groove ⅜" from bottom
⅛" rabbet ⅜16" wide along all sides
1¼ x 1 1/16" brass butt hinges
2¼"
1½"
H
¼"
⅞"
C
2 3/16"
E
H
H
¼" groove ¼" deep ¼" up from bottom
½"
½"
9/32"
5/32"
½"
¾"
9/16"
5/16"
½"
¾"
D
D
C
B
G
G
⅝"
⅝"
¼" rabbet 5/16" wide
F
#16 x ¾" brads

them into the "mouseholes" in the back ends of the sides created by the grooves. Note: The other mouseholes will be concealed by the base. Scrape or plane the joints flush, then finish-sand the box exterior.

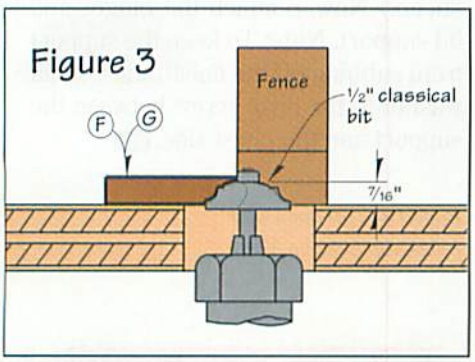
Add a Base To the Box, Then Fit the Lid

Step 1. For the base front (F) and sides (G), first cut a 4½x18" piece of ½"-thick stock. Fit your table-mounted router with a ½" classical bit, and set it to cut 7/16" deep, as shown in *figure 3*. Lay the stock facedown, and rout both edges of the piece. Then, rip a pair of 2⅛"-wide strips from the piece to use as base trim.

Step 2. From these two shaped strips, fit and miter-cut a base front to length, then miter one end of each base side. Dry-fit the base pieces around the box, then trim the back ends of the sides to length.

Step 3. Transfer the full-sized Base pattern to both ends of the three base pieces. Bore ½" holes where shown on the pattern, then scrollsaw the rest of the profile to shape. Next, drill 1/16" pilot holes through the parts where shown on the Exploded View drawing.

Figure 3

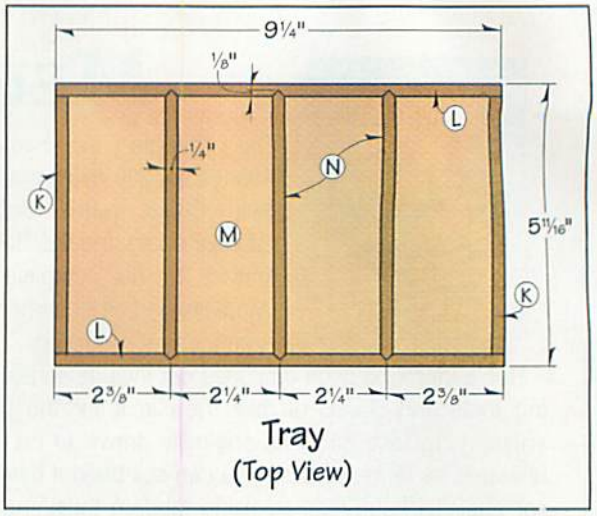


Finish-sand the three pieces, then glue and nail them to the box where dimensioned on the Exploded View drawing, gently clamping the miter joints. (We used a marking gauge to scribe a line for positioning the base.) After the glue has dried, set the nails, fill the holes, then sand the fills flush.

Step 4. From ½" stock, cut two base supports (H) to shape. (For dimensions, see the detail shown with the Exploded View drawing.) Glue and clamp them to the bottom edge of the back and the back faces of the base sides. After the glue has dried, cut four 1 7/16"-long pieces of your remaining ¼x¼" stock, then glue and clamp them in the inside corner of each base joint for reinforcement.

Step 5. Measure the outside width and length of the box. Add 1/16" to both dimensions, then cut the lid to this size. Next, position a pair of small brass butt hinges on the bottom face where dimensioned on the Exploded View drawing. (We used 1¼x1 1/16" hinges. If you wish to mail-order these and a lid support, see the Kit Source on *page 26*.) Scribe around the edges with a sharp X-acto knife, chop the mortises, then drill 1/16" pilot holes ⅜" deep for the screws. (The screws furnished with the hinges were too long for our lid, so we substituted #4x⅜".)

Step 6. To make the lid moldings (I, J), first cut a 2x18" piece of ½"-thick stock. Rout a ⅜"-deep cove along both edges of the stock. (We used a ⅜"-radius cove bit.) Note: Lay the stock facedown—not on its edge—to rout this cove. Rip a ¾"-wide molding strip from each edge, then cut one 13" and two 8" lengths from these strips.



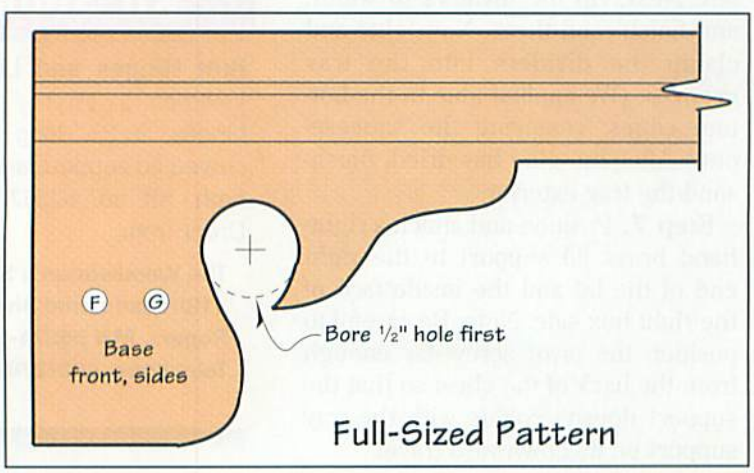
Tray
(Top View)

Step 7. Fit and miter-cut the front molding from the 13"-long piece, then glue and clamp it to the front edge of the lid. Next, miter one end of each 8" piece, then position both pieces along the lid ends to establish length. Mark and trim the back ends, then drill two 1/16" pilot holes through each side molding where shown on the Exploded View drawing.

Step 8. Apply glue to the mitered front end and the first 1" of the adjacent edge of each side molding. Then, nail the moldings to the lid using #16x¾" brads, and clamp the miter joints. Note: The brads will allow the lid some seasonal movement. We used the glue to help keep the joints closed.

Later, set the brads, fill the holes, and then sand the fills flush after they've cured.

Step 9. Center the lid over the chest, and position the hinges along the top back edge of the chest. Scribe and chisel these mortises, then drill pilot holes. Now, screw the hinges to the box and check the action.



Full-Sized Pattern

Build the Tray, Then Add Finishing Touches

Step 1. From ¼"-thick stock, cut the tray sides (K) to size. To make the front and back (L), cut a 5"-wide piece of the same stock to the length listed in the Bill of Materials. Next, fit your

Meet the Designer

The shingle in Hackensack, Minnesota, 200 miles north of the Twin Cities, reads *Bob Dillon Windsor Chairs.* Indeed, Bob is best known for his complete line of Windsors and other authentic Early American reproductions.

Bob's idea of a good day does not include shrieking electric tools and clouds of dust; he's in it for the hand-tool artisanry. In fact, Bob was originally drawn to his specialty because, as he maintains, "you can still build a better Windsor chair by hand than by using modern tools and streamlined techniques."

Bob's only formal wood-related training is a forestry degree from the University of Massachusetts. After college, he moved west and put in several years of "timber cruising" for the Forest Service, i.e., evaluating the resources on government-owned lands before the timber rights are leased out. Bob never got tired of spending his days in the woods, but the predictability of a civil-service career made him antsy.

The first woodworking tools he picked up came as an inheritance from his grandfather—a few well-seasoned planes, chisels, and handsaws. "Now and then I noticed these old tools lying around," Bob recalls, "and started feeling some kind of obligation to learn how to use them." He developed enough skill to hire on with a small production shop, gradually setting up his own venture and acquiring some business sense along the way. Three years ago, he went completely on his own.

Bob now exhibits at a dozen crafts shows a year and has developed a national customer list. A member of the American Crafts Council and Minnesota Crafts Council, he was honored to receive a listing in *Early American Life* magazine's Directory of Fine Craftsmen for 1994.

table-mounted router with a V-groove bit set to cut a ¼"-wide groove. (We ran test pieces to adjust to this width, which required elevating the bit to just shy of ⅛".) Set the fence, then rout a groove centered 2⅜" from one end of the piece where dimensioned on the Tray drawing on *page 25.* Turn the stock end for end, and rout the other end groove. Now, reset the fence, and rout the center groove where dimensioned. Note: Save this router setup to make the dividers in Step 5.

Step 2. Trim the outfeed edge from your grooved workpiece to remove any tear-out. Next, rip the front and back parts to width. Then, cut tails in the sides and pins in the front and back using your jig and router, adjusting the depth of cut to allow for the ¼"-thick stock; or, lay out and hand-cut the joints as dimensioned in *figure 2.* (Again, we scribed the shoulder layout lines with a marking gauge for appearance's sake.)

Step 3. Fit your tablesaw with a ⅛"-wide blade, and cut a ⅛"-deep groove ⅜" up from the bottom edge of the tray front, back, and sides. Next, rip and crosscut a tray bottom (M) from ¼" stock, and cut a 3/16"-wide rabbet ⅛" deep along the bottom edges and ends. Dry-assemble the tray to check the fit of the bottom in its groove.

Step 4. Finish-sand the inside faces of the tray parts. Next, glue, assemble, and clamp the tray, allowing the bottom to float in its groove without glue. After the glue has dried, cut four ⅛x⅛x¼" plugs and glue them into the "mouseholes." Plane or scrape the joints flush.

Step 5. Measure the interior width of the tray (point of V-groove to point of V-groove) to determine divider (N) length. Rip a 6"-wide piece of ¼"-thick stock to this length. Next, make a zero-clearance fence to use with the router setup you saved earlier. To do this, cut a straight, flat length of 5/4 scrap stock, and make a pass across the bit to cut the V-groove profile in one edge. Set the fence to "bury" exactly half the bit's diameter. Now, lay the workpiece flat, and rout a bevel on both faces at both ends.

Step 6. Joint the outfeed edge of the divider stock to remove any tear-out. Next, rip the dividers to width, and finish-sand them. Now, glue and clamp the dividers into the tray grooves. (We applied glue to the bottom edges, removing the squeeze-out.) After the glue has dried, finish-sand the tray exterior.

Step 7. Position and attach a right-hand brass lid support to the right end of the lid and the inside face of the right box side. Note: Be careful to position the pivot screw far enough from the back of the chest so that the support doesn't collide with the tray support on its downward travel.

Step 8. Remove the hardware, and finish-sand any surfaces that still need it. Next, apply your choice of finish to the chest, the lid, and the tray. (We brushed on a liberal coat of Minwax Antique Oil Finish, wiping off the excess after 10 minutes. We then rubbed on two additional coats using a clean cotton cloth. After the last coat had dried for 24 hours, we applied a coat of paste wax and buffed it to a low sheen.) Now, reattach the hinges and lid support. Note: To keep the support from rubbing off the finish, add a small washer to the pivot screw between the support and the chest side.

Project design: *Bob Dillon*
Photograph: *Studio Alex*

Kit Source

Butt Hinges and Lid Support. Includes 2–1¼x1 1/16" brass butt hinges, a 2¾"-long brass-finish curved lid support, and screws for both. Kit no. 63552, $6.95 ppd. Order from:

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VINTAGE 'DOZER AND TRACTOR/ TRAILER RIG

While working a summer construction job back in the '60s, Ed Schmidt got interested in all the heavy equipment rumbling around him. Years later, as he and his wife Carole developed their wooden toy business, Ed drew inspiration from nostalgia. He designed a crane, a front-end loader, dump truck, and scraper, as well as the combination you see here. We think your kids or grandkids will find the Schmidts' toys as hard to put down as you'll find them satisfying to build. (For more about the Schmidts and their toys, see "Meet the Designers" on page 36.*)*

Start With the 'Dozer

Step 1. From ¾"-thick stock, rip and crosscut a chassis (A) and base (B) to the dimensions listed in the Bill of Materials. (We used walnut.) Next, tilt your saw blade to 30° from perpendicular, and bevel-cut the back end of the base where shown on the Dozer Chassis drawing *opposite*. Now, sand the bevel smooth.

Step 2. Lay out and drill two ⅜" holes ¼" deep in the front end of the chassis where shown on the Exploded View drawing. Locate the centerpoints ½" up from the bottom and ½" in from each edge. Next, transfer the full-sized Dozer Hitch pattern shown on *page 30* to the back end of the chassis, and mark the hole centerpoint with an awl. Then, bandsaw and sand the end to the line. Now, fit your table-mounted router with a ¼" round-over bit, and rout the top edge of the contoured back end you just cut.

Step 3. Glue and clamp the base to the top face of the chassis, aligning the front ends. After the glue has dried, turn the laminated assembly on its edge, and rout a round-over along the beveled ends of the base, continuing along the short stretch of straight chassis edge (to blend with the contoured edge you just routed). With the assembly still lying on edge, rout the front corners.

Now, lay the piece flat, and rout the entire bottom edge of the chassis.

Step 4. Lay out and drill 7/16" axle holes through the chassis where dimensioned on the Dozer Chassis drawing. To do this, clamp the chassis to a fence on your drill-press table and use a brad-point bit. (We inserted a backing board underneath to minimize chip-out.) Next, bore the 5/8" hole 1/4" deep for the trailer hitch where marked. Now, sand the assembly smooth.

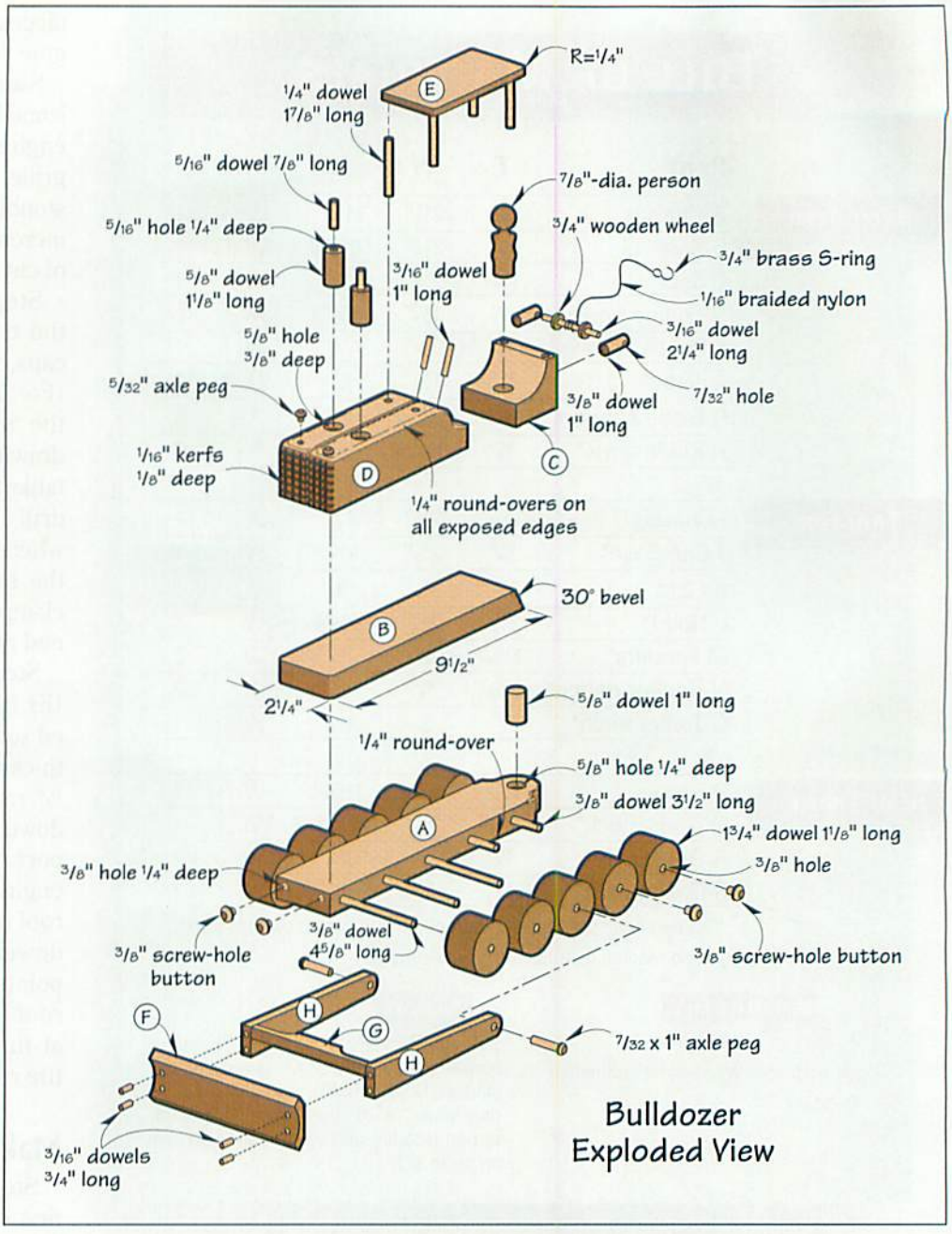
Add the Seat, Engine Housing, and Cab Roof

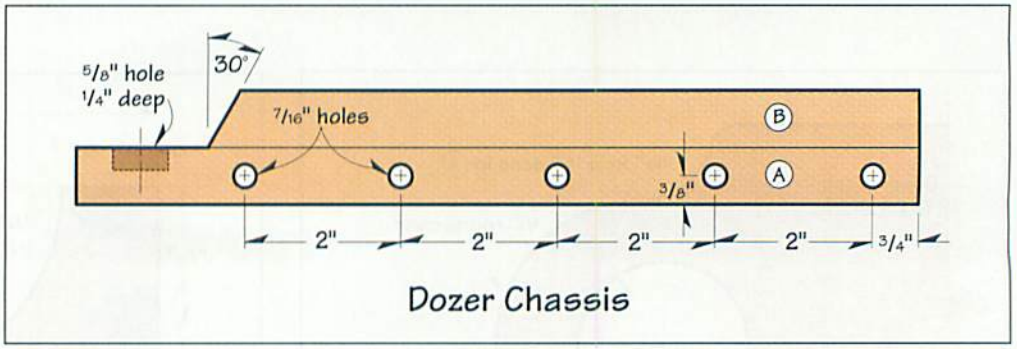
Step 1. To make the seat (C), first cut a 2"-long by 2 1/4"-wide piece of 1 3/4"-thick stock. (We used walnut. You can also laminate thinner material.) Bore a centered 7/8" hole 1 3/8" deep for the operator where shown on the Seat pattern on *page 30*. Next, lay out and drill 1/4" holes for the roof posts and 3/8" holes for the winch supports. (For locations, see the Seat pattern and the Seat/Engine Housing Top View drawing on *page 31*.) Transfer the full-sized Seat pattern to one edge of the blank, then bandsaw the seat to shape. Now sand it smooth.

Step 2. Rout a 1/4" round-over on all seat edges except for those that mate with the engine housing and base and those along the top of the seat back. Finish-sand the seat, then glue and clamp it to the base, aligning it with the beveled end.

Step 3. To make the engine housing halves (D), first plane a 2 x 14" piece of contrasting 5/4 stock to 1"-thick. (We used hard maple.) Crosscut this piece into two blanks of identical length. Transfer the full-sized Engine Housing pattern (side view) shown on *page 31* to one of them, then stack the two blanks using double-faced tape. Next, adhere the Top View pattern to the top edge of the back end of the adhered pieces. Bandsaw the top-view pattern first, then the side-view profile. Now, sand the sawn edges smooth.

Step 4. Separate the engine pieces, and rout a 1/4" round-over along all edges except for those that mate with the base and seat. Note: Rout the inside edges as well where the two pieces join. Then, glue, align, and clamp the two engine





Bill of Materials

	Part	T	W	L	Mat.	Qty.
Bulldozer	A Chassis	¾"	2¼"	11¼"	W	1
	B Base	¾"	2¼"	9½"	W	1
	C Seat	1¾"	2¼"	2"	W	1
	D Engine housings*	1"	1¾"	6¾"	M	2
	E Roof	¼"	2¼"	4½"	W	1
	F Blade*	½"	1¾"	6"	O	1
	G Blade support	⅜"	¾"	4 11⁄16"	A	1
	H Blade arms*	⅜"	1 1⁄16"	6¼"	A	2
Tractor	I Chassis	1 1⁄16"	2½"	12"	W	1
	J Cab Base*	¾"	2½"	4¼"	W	1
	K Cab*	3½"	3½"	4⅜"	WL	1
	L Hood*	2½"	2¾"	2¾"	W	1
	M Fenders*	1 1⁄16"	2"	2¼"	W	2
	N Rocker panels*	1 1⁄16"	¾"	4¼"	W	2
	O Trailer hitch*	1"	2"	2¼"	W	1
Semi-Trailer	P Base	1 1⁄16"	2¼"	18⅜"	W	1
	Q Gooseneck*	2⅝"	2¼"	7¼"	WL	1
	R Outriggers*	¾"	1"	9¼"	W	2
	S Dozer cleat*	⅜"	¾"	¾"	W	1

*Cut part oversized initially, then cut to size during construction.

Please read all instructions before cutting.

Materials List

A–ash
M–maple
O–oak
W–walnut
WL–walnut lamination

Supplies

3⁄16", ¼", 5⁄16", ⅜", ½, ⅝", and 1" birch or maple dowel stock; ¾" cherry dowel stock; ¾" walnut dowel stock; ¾" brass S-ring hook; 1⁄16" braided nylon. (For other turned wooden parts, see the Kit Source on *page 37.*)

pieces face to face, removing any glue squeeze-out.

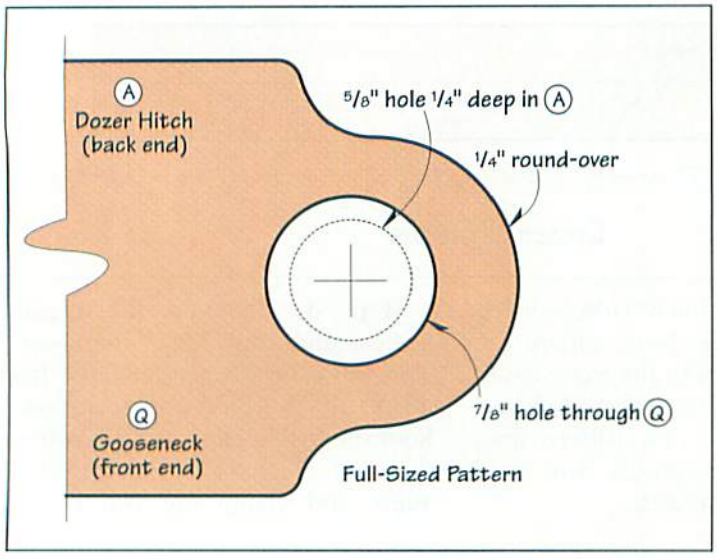
Step 5. Bandsaw vertical and horizontal kerfs on the front end of the engine housing to create the radiator grille. To do this, use a fence and stopblock, moving the fence in ¼" increments and limiting the depth of cut to ⅛".

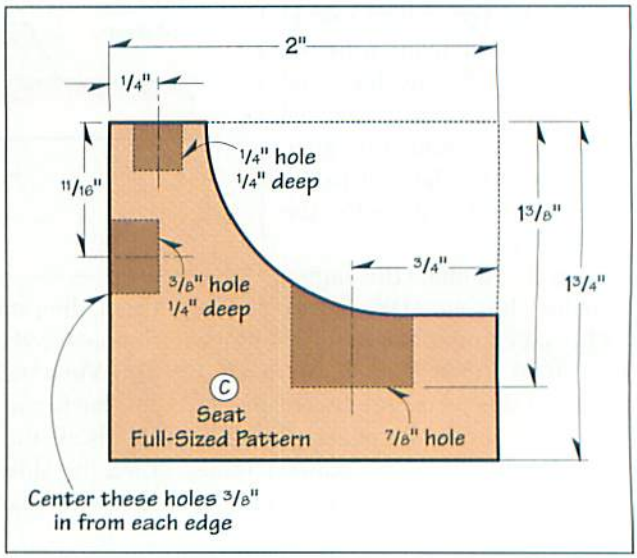
Step 6. Lay out and drill holes in the engine housing for the radiator caps, stacks, and roof support posts. (For locations and dimensions, see the Seat/Engine Housing Top View drawing.) Next, tilt your drill-press table to 30° from perpendicular, and drill the two control-lever holes where shown on the pattern. Sand the housing smooth, then glue and clamp it to the base, butting the back end against the seat.

Step 7. Rip and crosscut the roof (E) from ¼"-thick stock. (We resawed some of our leftover walnut to this thickness.) Next, bandsaw or sand a ¼" radius on each corner. Insert ¼" dowel centers in the four roof support holes on the seat back and engine housing. Then, center the roof over the four holes, and use the dowel centers to transfer centerpoints onto the underside of the roof. Now, drill ¼" holes ⅛" deep at these four points, and then sand the roof smooth.

Make the 'Dozer Blade

Step 1. To make the blade (F), first cut a ½"-thick blank to 1¾ x 12". (We used red oak. As a simpler





alternative, you can buy 1¾"-wide oak cove molding at your local building-supply center.) Starting 1" from one end, lay out and drill two pairs of 3/16" holes 5" apart where shown on *figure 1* on *page 32*. Fit your table-mounted router with a 1¾"-radius core-box bit set to cut ¼" deep. Then, using a fence, rout one face of the stock where shown.

Step 2. Move your tablesaw rip fence to the side of the blade opposite its direction of tilt. Tilt the blade to 45° from perpendicular, and lay the blank on its non-coved face. Then, set the fence, and bevel-rip both edges along lines *B-B1* where shown on *figure 1*. To make the *C-C1* cuts, first bevel-rip a 12" length of 2×4 at 45°, and adhere it (using double-faced tape) to the back face of the blank as a carrier board. Reset the blade to perpendicular, and bevel-rip one edge along *C-C1*. Turn the blank end for end, readhere it to the carrier board, and rip the other *C-C1*. Note: Set the fence so the blade just strikes the edge of the cove without removing any of its width.

Step 3. Lay out and crosscut the 6"-long blade from your blank, centering it with respect to the holes. (They should be ½" in from each end of the blade.) Then, sand the blade smooth.

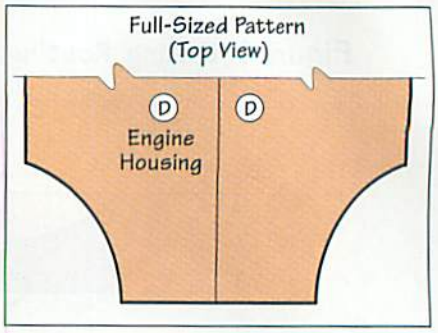
Step 4. To make the blade support (G) and blade arms (H), first transfer the full-sized patterns shown on *page 33* to 3/8"-thick stock. (We used ash. For the arms, we stacked two thicknesses.) Bandsaw and sand the parts to shape, then drill the holes in the arms where dimensioned on the pattern. Now, adhere the three pieces to carrier boards for safety, and rout a round-over on all non-mating edges of the three parts (1/16" radius on part G, 1/8" on parts H).

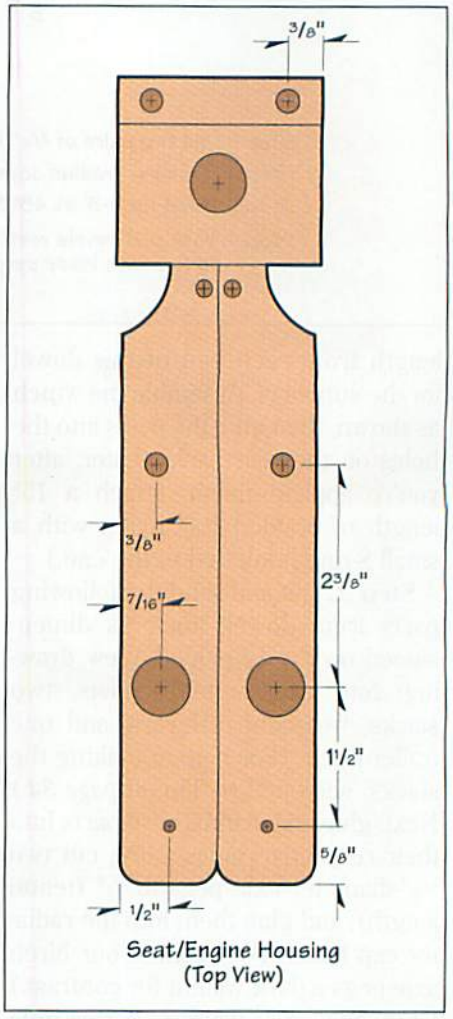
Step 5. Glue and clamp the arms to the blade, centering the ends over the two pairs of holes you drilled in the blade. (We cut a ¾×4 11/16×6" scrap piece to use as a gluing form. Using heavy-duty rubber bands, we secured the blade to this form, then the arms to the form. We then clamped the arms to the blade.) Allow the glue to dry thoroughly. Now, glue and clamp the blade support to the back of the blade between the arms 1/16" down from the beveled edge.

Step 6. Using the blade holes as guides, carefully drill 3/16" holes 3/8" deep into the arms. (We used a portable drill and brad-point bit, clamping the assembly in our vise before drilling.) Next, glue and insert ¾" lengths of 3/16" dowel into the holes. Sand them flush after the glue has dried.

Now, Assemble the Whole 'Dozer

Step 1. To make the winch, cut a 2¼" length of 3/16" dowel, then glue and drive two ¾"-diameter wheels onto it, spacing them 1" apart. (For reference, see the Exploded View drawing.) Next, cut a 3" length of 3/8" dowel, and drill a centered, 7/32" hole ¼" from each end. Then, cut a 1"





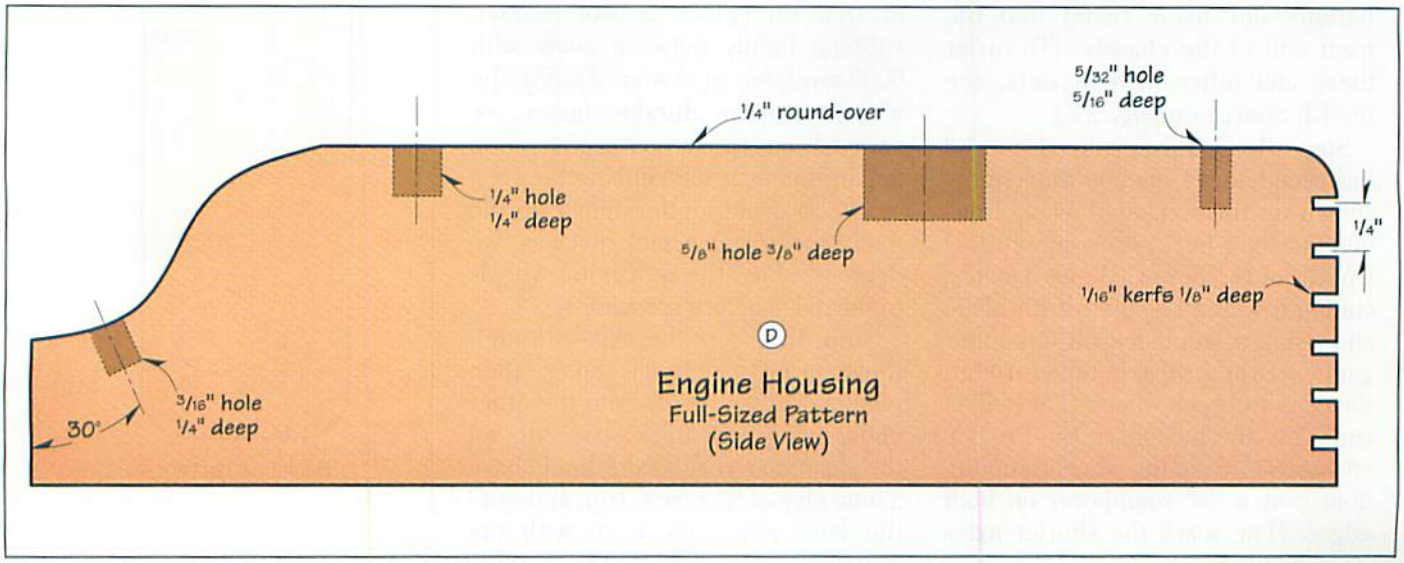
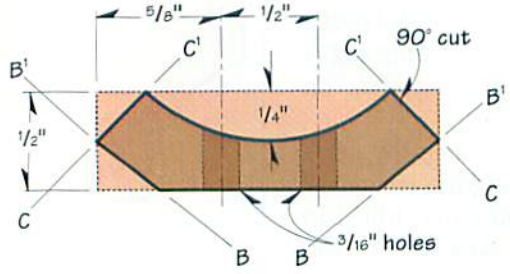


Figure 1 Drilling, Routing, and Bevel-Ripping the Blade



Step 1: Drill two pairs of 3/16" holes 5" apart, 5/8" from edge
Step 2: Rout 1 3/4"-radius cove 1/4" deep
Step 3: Bevel-rip B-B' at 45° from perpendicular
Step 4: With B-B' bevels resting on table and against fence, rip C-C' with blade perpendicular

length from each end of this dowel for the supports. Assemble the winch as shown, then glue the posts into the holes on the seat back. (Later, after you've applied finish, attach a 15" length of braided 1/16" nylon with a small S-ring hook tied to the end.)

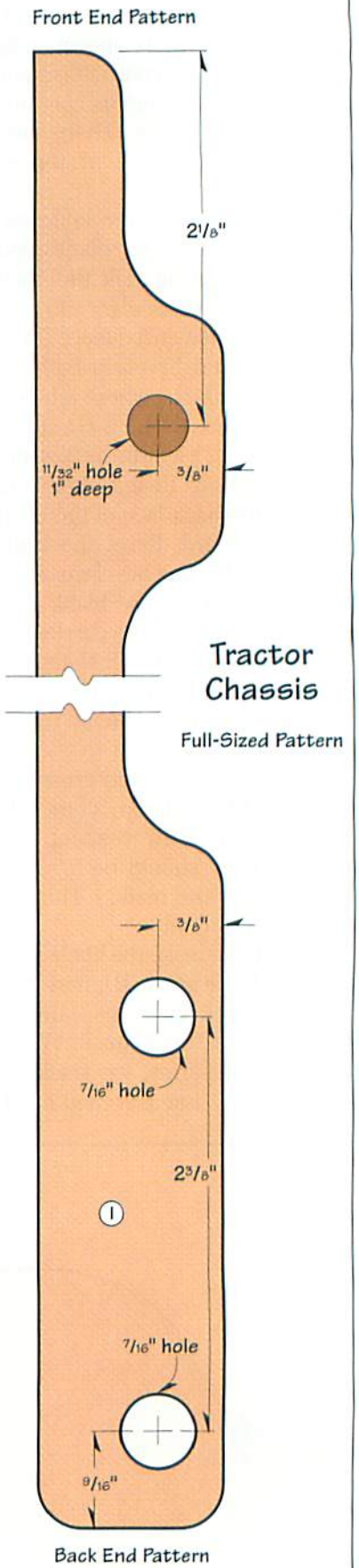
Step 2. Cut and sand the following parts from dowel stock as dimensioned on the Exploded View drawing: four roof support posts, two stacks, two control levers, and one trailer hitch. (For help in making the stacks, see our Pro Tip on *page 34.*) Next, glue and clamp these parts into their respective holes. Now, cut two 5/32"-diameter axle pegs to 1/4" (tenon length), and glue them into the radiator cap holes. (We stained our birch axle pegs a dark walnut for contrast.) Glue two 3/8" walnut screw-hole buttons (for blade rests) into the front end of the chassis. (To order these and other turned parts, see the Kit Source on *page 37.*)

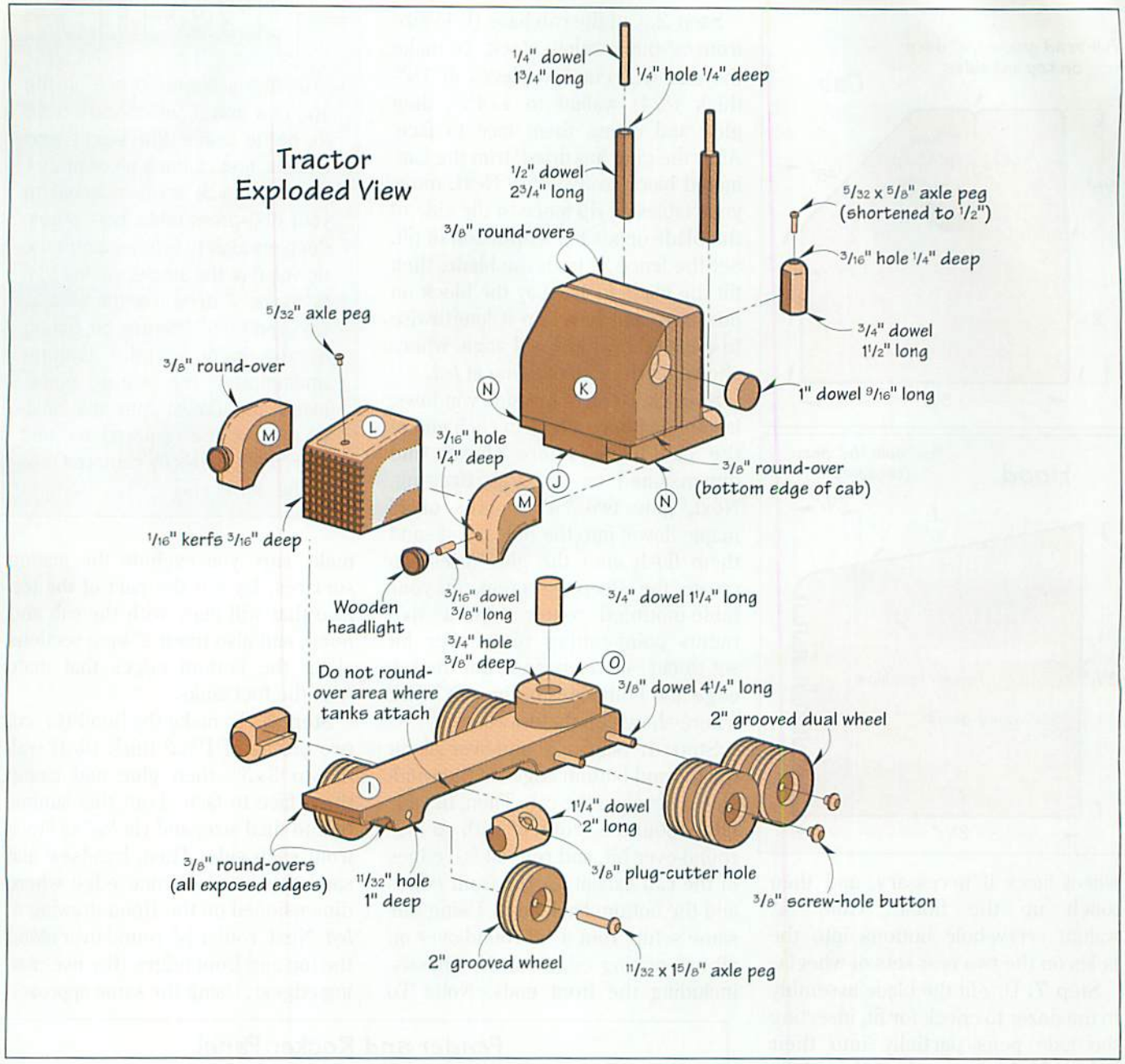
Step 3. Cut five axles from 3/8" hardwood dowel stock to the lengths shown on the Exploded View drawing. For the wheels, crosscut ten 1 1/8" lengths of 1 3/4" dowel. (We used maple, cutting it with an 80-tooth trim blade and using a stopblock on our miter gauge.) Drill a 3/8" axle hole through the center of each wheel. (For help in centering the holes, see the Pro Tip on *page 34.*) Sand the wheels smooth, then rout a 1/16" round-over on both edges. Now, mark the shorter axles 1/2" from one end, then glue and drive each one that far into a wheel. Drive the longer axles all the way to the outside faces of the wheels.

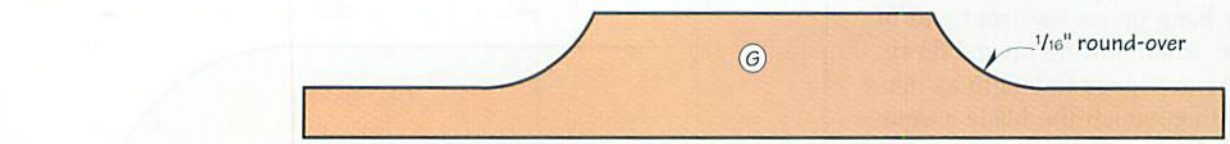
Step 4. To attach the blade assembly to the middle (third) axle, first dry-assemble a second wheel to one of the 4 5/8" axles. Stand the assembly upright (on the end of one wheel), and insert the wheel into the jig you made to drill axle holes. Using a brad-point bit, drill a centered, 7/32" hole 3/4" deep in both ends of the 3/8"-diameter axle. Then, disassemble the parts for finishing.

Step 5. Finish-sand any parts that still need it, then apply your choice of finish to the dozer, the blade assembly, axles, wheels, and a "little person." (We sprayed the 'dozer, blade assembly, and person with three coats of Deft semi-gloss aerosol lacquer, rubbing lightly between coats with 0000 synthetic steel wool. To give the wheels a more durable finish, we sprayed on three coats of a satin polyurethane, again rubbing between coats. To avoid getting finish on the mating axle and wheel surfaces, we dry-assembled the remaining wheels to the axles before spraying.)

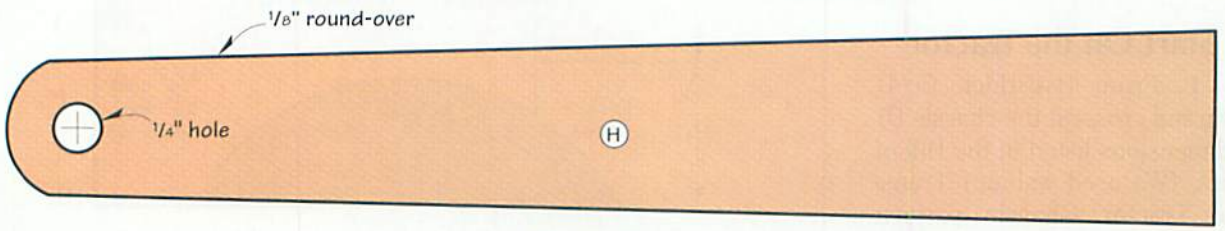
Step 6. Insert the axles through the appropriate chassis holes, then glue and drive wheels onto the other ends, using a 1/8"-thick spacer to set the clearance. (Each axle should have a total play of 1/8".) Now, trim and sand the long axle ends flush with the



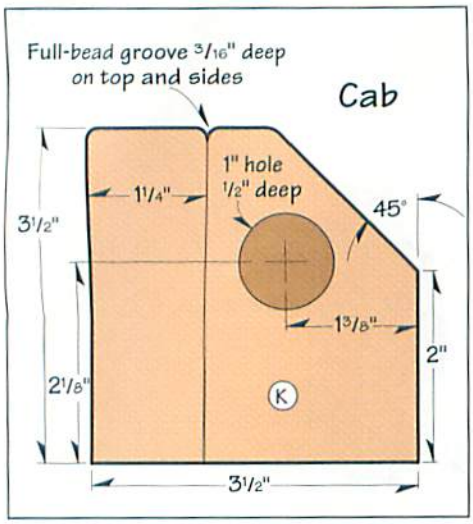


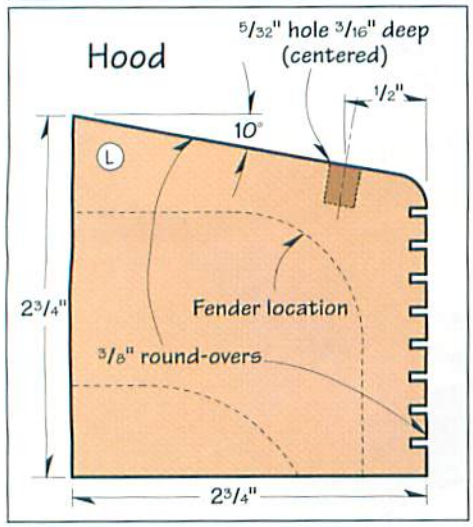


Blade Support
Full-Sized Pattern



Blade Arm
Full-Sized Pattern





wheel faces if necessary, and then touch up the finish. Glue 3/8" walnut screw-hole buttons into the holes on the two rear sets of wheels.

Step 7. Dry-fit the blade assembly to the dozer to check for fit, inserting the axle pegs partially into their holes. Make sure that the blade support catches on the buttons but doesn't hang up on the front end of the base when moving up and down. Trim the axle pegs to length as necessary, then attach the blade assembly by gluing and driving the pegs into the wheel holes.

Now, Start On the Tractor

Step 1. From 1 1/16"-thick (5/4) stock, rip and crosscut the chassis (I) to the dimensions listed in the Bill of Materials. (We used walnut.) Transfer the Tractor Chassis pattern shown on *page 32* to one edge of the chassis, then drill the axle holes where dimensioned. Now, bandsaw and sand the chassis profile to shape.

Step 2. Cut the cab base (J) to size from 3/4"-thick walnut stock. To make the cab (K), cut two pieces of 1 3/4"-thick (8/4) walnut to 4 x 4 3/4", then glue and clamp them face to face. After the glue has dried, trim the laminated block to 3 1/2 x 4 3/8". Next, move your tablesaw rip fence to the side of the blade opposite its direction of tilt. Set the fence 2" from the blade, then tilt the blade to 45°. Lay the block on one face, and bevel-rip it lengthwise to create the windshield angle where shown on the Cab drawing at *left*.

Step 3. To form the side windows, lay out and bore a hole in each end of the cab blank where shown and dimensioned on the Cab drawing. Next, glue two 9/16" lengths of 1" maple dowel into the holes, and sand them flush after the glue dries. To create the sleeper section, fit your table-mounted router with a 3/16"-radius point-cutting round-over bit set to cut 3/16" deep, and rout the top edge and both sides of the cab blank where shown on the drawing.

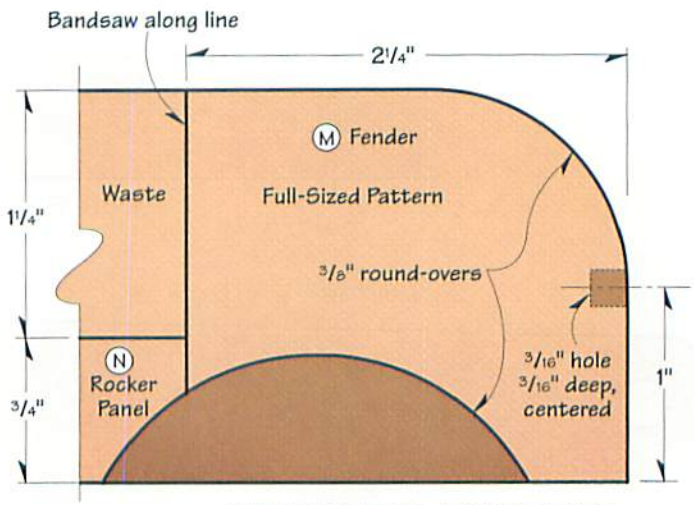
Step 4. Sand a round-over along the top and bottom edges of the windshield bevel on the cab. Then, fit your table-mounted router with a 3/8" round-over bit, and rout all 90° edges of the cab except for the front edges and the bottom back edge. Using this same setup, rout a 3/8" round-over on all non-mating edges of the chassis, including the front ends. Note: To make sure you exclude the mating surfaces, lay out the part of the top face that will mate with the cab and hood, and also mark 2"-long sections along the bottom edges that mate with the fuel tanks.

Step 5. To make the hood (L), cut two pieces of 1 15/16" thick (6/4) walnut to 3 x 3", then glue and clamp them face to face. Trim this lamination to final size, and rip 1/16" of stock from each side. Then, bandsaw and sand the bevel on one edge where dimensioned on the Hood drawing at *left*. Next, rout a 3/8" round-over along the top and front edges (the non-mating edges). Using the same approach

PRO TIP

To drill a centered hole in the end of a dowel, which you'll need to do to make the stacks and wheels, first clamp a piece of 2 x 4 or other thick scrap material to your drill-press table. Bore a hole deep enough to firmly support the dowel. (For the stacks, we bored a 5/8" hole 1/2" deep. For the wheels, we used a 1 3/4" Forstner bit, boring to the same depth.) Without unclamping the scrap piece, insert the dowel into the hole. Change to the required bit, and then drill a perfectly centered hole in the dowel end.

Fender and Rocker Panel



1. Stack two blanks, drill holes in ends
2. Bandsaw wheel well, sand smooth
3. Crosscut (M) to length on bandsaw
4. Rip waste from (N)

you used on the 'dozer, bandsaw the radiator grille. Now, drill a 5/32" hole 3/16" deep (perpendicular to the bevel) where shown on the drawing.

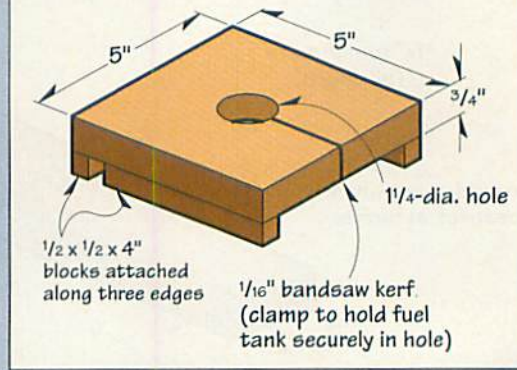
Step 6. To make the fenders (M) and rocker panels (N), first transfer the pattern shown *below left* to a 2 x 7" piece of 1 1/16"-thick (5/4) walnut stock. Stack this patterned piece on top of an identical second piece using double-faced tape, then drill a headlight hole in one end of each piece where dimensioned on the pattern. Next, bandsaw and sand the parts to shape. (We used our oscillating spindle sander to smooth the wheel wells.) Crosscut the stacked pieces where shown on the pattern, then separate the pieces and rip the rocker panels to finished width.

Step 7. Finish-sand all parts, then glue and clamp the following parts in order: the hood to the chassis, aligning the front ends; the rocker panels to the cab base edges, aligning the parts flush; the cab base/rocker panel assembly (after sanding it flat on both faces and trimming the back ends flush) to the chassis and hood; the cab to the cab base, rocker panels, and hood; the fenders to the hood, cab, and rocker panels. Remove squeeze-out wherever possible, and allow the glue to dry after each glue-up.

Making the Fuel Tanks

To round the ends of the tanks, as well as bore a plug hole and cut away a right-angled gluing notch, we suggest making the simple jig shown in *figure 2*. To use the jig, insert the 2" length of dowel into the hole until the bottom end rests squarely on your router table, then clamp the jig to hold the dowel tight. Holding the jig so that you can watch the action through the open (kerfed) edge, rout a 3/8" round-over, circling the bit with the jig while pressing the dowel firmly against the pilot bearing. Turn the dowel end for end, and repeat.

Figure 2: Fuel Tank Jig



To cut the 90° gluing notch, set your bandsaw rip fence so that the blade will track through the kerf you already cut, and remove the clamp from the jig. (For this step, the jig should hold the tank firmly enough without a clamp.) Lay out the 1/2 x 1/2" notch on one end of the dowel, then, using the kerf as a guide, cut one side of the notch. Now, turn the dowel 90° in the jig, and make the second cut to complete the notch.

To bore the 1/4"-deep plug for the filler cap, turn the jig on edge, and clamp it to a fence on your drill-press table. Position the dowel to drill a centered hole 5/8" from one end and approximately 45° around the circumference from the notch. Note: You want the filler cap to face upward at a 45° angle once the tank is glued in place. Reclamp the jig to hold the dowel firmly, then, using a 3/8"-diameter plug cutter, bore a 1/2"-deep hole.

Next, Add the Detail Work

Step 1. Sand the fenders and rocker panels flush with the cab sides. Next, rout a 3/8" round-over along all outside edges of the tractor (except for the back end of the rocker panel), including the rocker panels, fenders, cab (front edges), and sleeper.

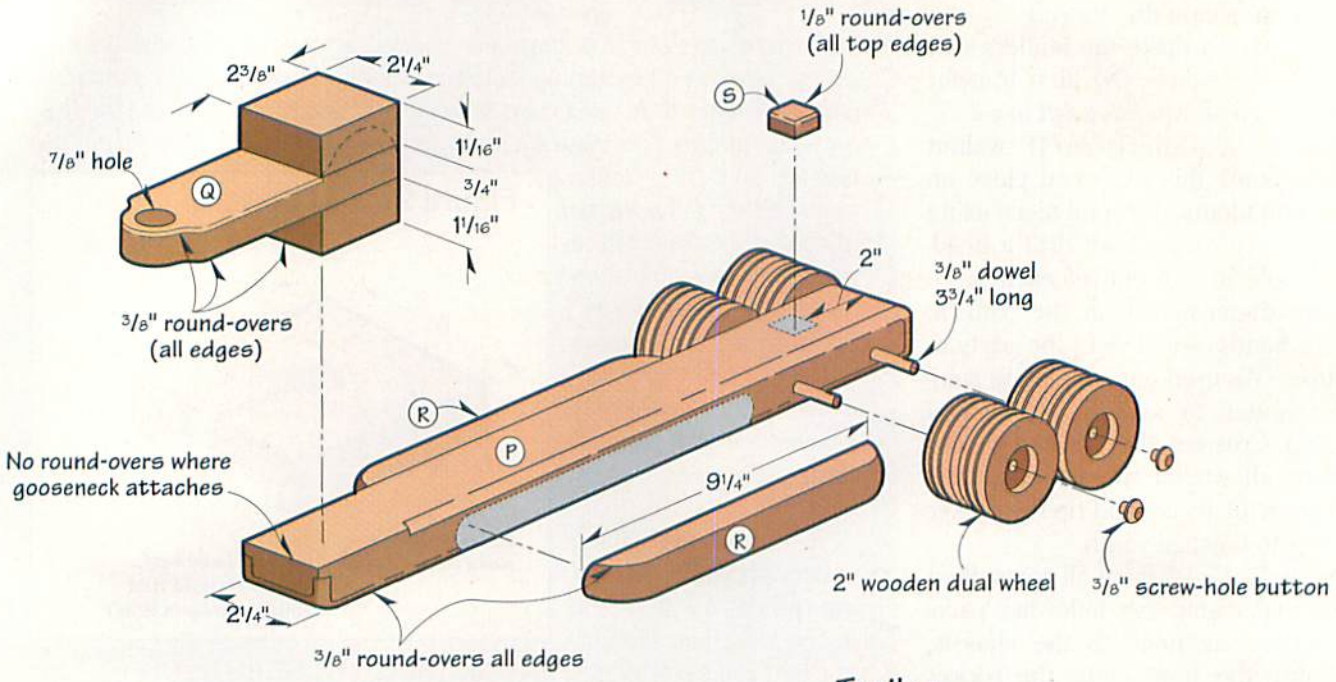
Step 2. To make the trailer hitch (O), first cut a 1 1/16 x 2 x 2 1/4" walnut blank. Next, resaw the piece to 1" thick. Find and mark a centerpoint on one face, then use this centerpoint to draw a 1"-radius half-circle on one end of the piece. Using this same centerpoint, bore the hole as dimensioned on the Exploded View, then bandsaw the half-circle. Now, rout a 3/8" round-over along the top edges. Glue and clamp the hitch to the chassis 3/4" from the back end, then cut and glue a 1 1/4" length of 3/4" walnut dowel in the hole.

Step 3. Make two fuel tanks from two 2" lengths of 1 1/4" maple or birch dowel. (See the Tractor Exploded View drawing. For help with machining the tanks, see "Making the Fuel Tanks" *above*.) Now, glue and clamp the tanks to the bottom edges of the chassis.

Step 4. Make the filter from 3/4" cherry dowel and a 5/32 x 5/8"-long axle peg, as shown on the Tractor Exploded View drawing. (We drilled a 5/32" hole 1/2" deep in the end of the dowel first, then rounded this end on our stationary disc sander.) Next, make the two exhaust stacks as dimensioned on the Exploded View. Note: Use the same approach you used to make the dozer stacks. Sand a flat edge on the stacks and filter, then glue and clamp them to the back of the sleeper. Next, drill a centered 3/16" hole 1/4" deep in the back of two 3/4" birch headlights. Using 3/16" lengths of 3/16" dowel, glue the headlights to the fenders. Now, trim the tenon on a 5/32 x 5/8" axle peg to 1/4" long, and glue it into the hole on the hood for a radiator cap.

Step 5. Next, cut two 4 1/4" lengths of 3/8" dowel for the rear axles, and mark them 3/4" from one end. Glue and drive each axle into a 2"-diameter dual grooved wheel to the 3/4" mark. Next, glue 3/8" buttons into the outside rear wheel faces.

Step 6. Apply finish to the tractor, wheels, axles, and axle-peg heads, following the same procedure you used for the dozer. After the finish has dried, insert the axles and attach wheels to the other ends, allowing 1/8" of space. Now, using 11/32 x 1 5/8" axle pegs, attach the 2"-



Trailer
Exploded View

Meet the Designers

When they started making wooden toys in 1972, Ed and Carole Schmidt didn't really intend to launch a family business, but these things have a way of getting out of hand. Today, *Toys 'n' Stuff* of Reynoldsburg, Ohio, offers about 50 different designs, including trains, planes, farm implements, fire engines, and construction equipment—not to mention the finest garbage truck design we've yet seen.

Ed attributes it all to a week he once spent in the hospital for tests. Beside himself with boredom and inactivity, he asked Carole to bring him his drafting tools. Before the week was out, he'd come up with a truck crane, a front loader, a steam shovel, and a hook-and-ladder truck. If he can have this kind of a week in the hospital, it's easier to understand how Ed and Carole both hold down professional jobs in the "real" world while *Toys 'n' Stuff* still maintains its usually frenetic production schedule.

In spite of it all, they decided a few years back that they might lose perspective if they let the business expand to something beyond a family operation. Nor were they crazy about hiring staff and thus putting themselves in the position of "management." So,

although they've acquired some fairly specialized industrial-grade tools to help expedite production, Ed and Carole still make and finish every toy themselves.

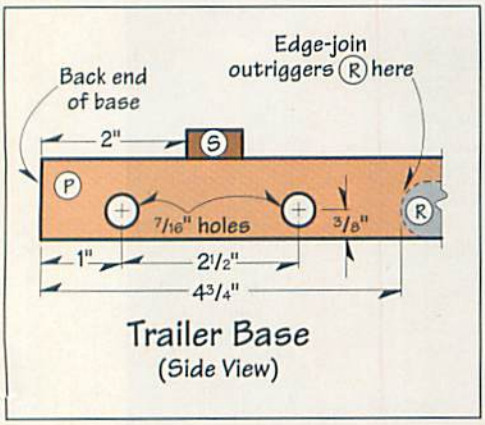
As members of the Ohio Designer Craftsmen, the Schmidts exhibit at about a dozen crafts shows a year in Ohio and throughout the Midwest. They've taken awards for their designs at three major shows, and had obviously captivated the crowd at last year's Columbus Arts and Crafts Festival, where we first met up with them.

diameter single front wheels, allowing 1/16" of clearance for each wheel.

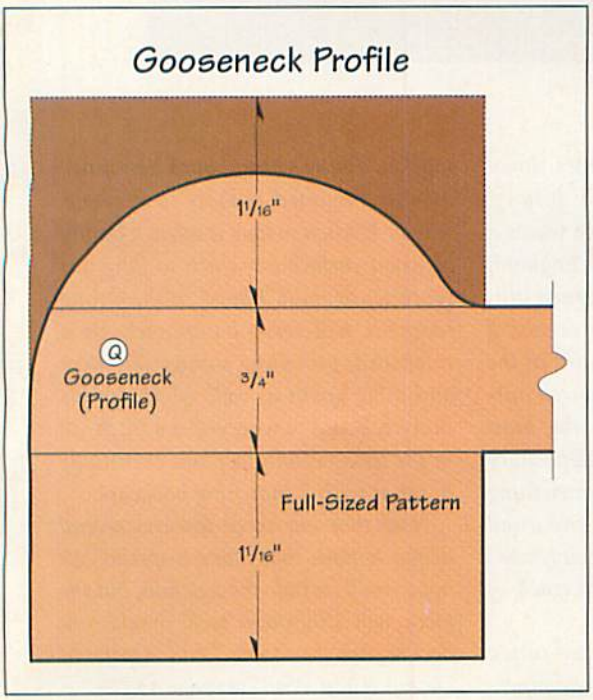
That Leaves the Lowboy Trailer

Step 1. From 1 1/16"-thick stock, rip and crosscut the trailer base (P) to the dimensions listed in the Bill of Materials. (We used walnut.) To make the gooseneck (Q), first cut two 2 1/4"-square pieces of the same stock. Next, cut a 2 1/4 x 7 1/4" piece of 3/4"-thick walnut stock.

Step 2. Transfer the Dozer/Gooseneck Hitch pattern you used earlier to one end of the 2 1/4 x 7 1/4" gooseneck piece. Next, bore a centered, 7/8" hole through the stock where shown on the pattern, then bandsaw and sand the contoured end to shape. Now, rout a 3/8" round-over on the top and bottom edges of the contoured end. Note: We'll rout the rest of the piece after assembly.



Trailer Base
(Side View)



Step 3. Sandwich the square end of the piece you just machined between the two 1 1/16"-thick squares you cut in Step 1, as shown on the Trailer Exploded View drawing. Glue the three pieces face to face and clamp, keeping them aligned. After the glue has dried, sand the edges of the gooseneck flush. Then, transfer the Gooseneck Profile pattern shown *below* to one edge of the back end. Bandsaw the profile to shape, then sand it smooth. Laminate this assembly to the front end of the trailer base, aligning the edges.

Step 4. Lay out and drill 7/16" axle holes through the trailer base where shown on the Trailer Base drawing at *left*. (We used a backing board and a brad-point bit.)

Step 5. To make the two outriggers (R), cut a 3 x 9 1/4" blank from 3/4"-thick walnut, and lay out a 3/4" radius at each corner. Next, bandsaw and sand the corners to shape. Then rout a 3/8" round-over along the top edge, including the radiused corners. Now sand the blank smooth, then rip a 1"-wide outrigger from each edge of the blank.

Step 6. Rout a 3/8" round-over on the top edges of the trailer base, including the gooseneck and block. Note: To do this, stand the trailer on edge. Then, rout the back corners of the base.

Step 7. Glue and clamp the outriggers (with the rounded edges up) to the trailer base where shown on the Trailer Side View drawing, aligning the bottom edges. (We used pipe clamps to help keep the edges in alignment.) After the glue has dried, sand the bottom face of the trailer and outriggers flat. Next, rout a 3/8" round-over along the bottom edges and ends of the assembled trailer and outriggers.

Step 8. To make the dozer cleat (S), first rip a 3/4 x 8" edge slice from a piece of 3/4"-thick walnut stock. Rout a 1/8" round-over along both edges and one end of one face. Crosscut the 3/4"-long cleat from this end of the blank. Then, double-face tape the cleat to one end of a 2 x 4 carrier board, aligning the crosscut (unrouted) end with one face of the carrier. Lay the carrier on this face, and rout the end. Now, sand the cleat smooth, then glue and clamp it to the trailer where shown on the drawing.

Step 9. Cut a pair of axles to 3 3/4" from 3/8" dowel stock, and glue one end of each into a 2"-diameter dual wheel. Next, finish-sand any surfaces of the trailer that still need it. Then, apply finish to the trailer and wheels, following the same procedure you used on the tractor. Now, install the wheels, spacing them as before.

Lead Photo: Kevin May
Illustrations: Cad Art

Kit Source

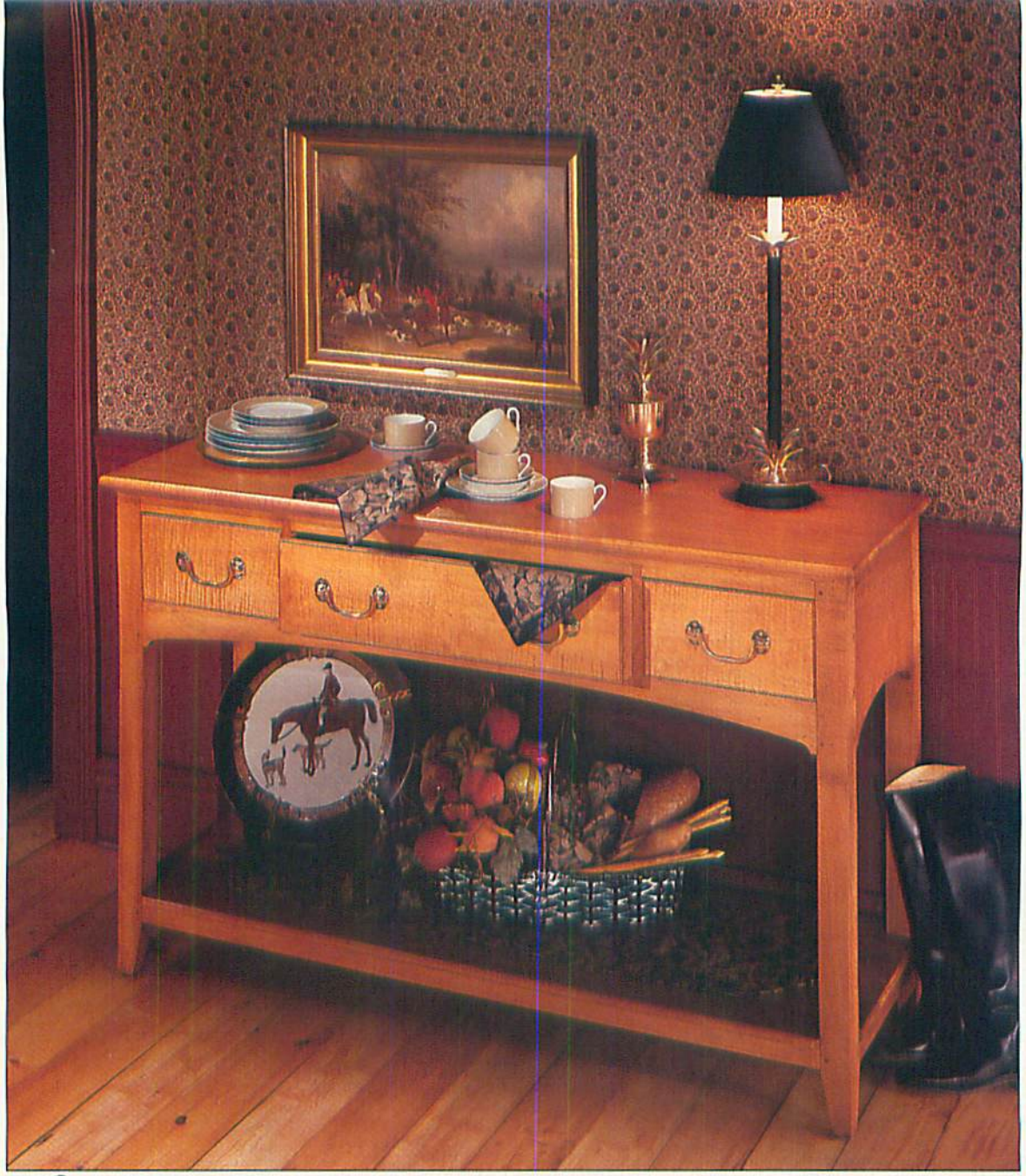
Wooden Parts. Includes 8–2"-dia. grooved dual birch wheels; 2–2"-dia. grooved single birch wheels; 7/8"-dia. birch little person; 20–3/8"-dia. walnut screw-hole buttons; 2–3/4"-dia. birch headlights; 2–11/32 x 1 5/8" birch axle pegs; 2–7/32 x 1 1/8" birch axle pegs; 4–5/32 x 5/8" birch axle pegs. Ask for kit no. 1264, $9.95 plus $3.50 shipping. (MN residents add 6.5% sales tax.) Order from:

Meisel Hardware Specialties
P.O. Box 70-J
Mound, MN 55364-0070
Telephone: 800/441-9870

Dowels. 1 3/4 x 36" birch or maple furniture-grade dowel (for dozer wheels). Catalog no. BD-1750, $5.75. 1 1/4 x 36" dowel (for fuel tanks). Catalog no. BD-1250, $2.75. Add $5.00 shipping/handling per order. (TX residents add 7% sales tax.) All other dowels required for this project also available, including cherry and walnut. Order from:

Woodworks
4500 Anderson Blvd.
Fort Worth, TX 76117
Telephone: 800/722-0311

Caution: *Since these toys have a number of small parts that could break off and present a choking hazard, we do not recommend them for children younger than three years of age.*



Hunt Board

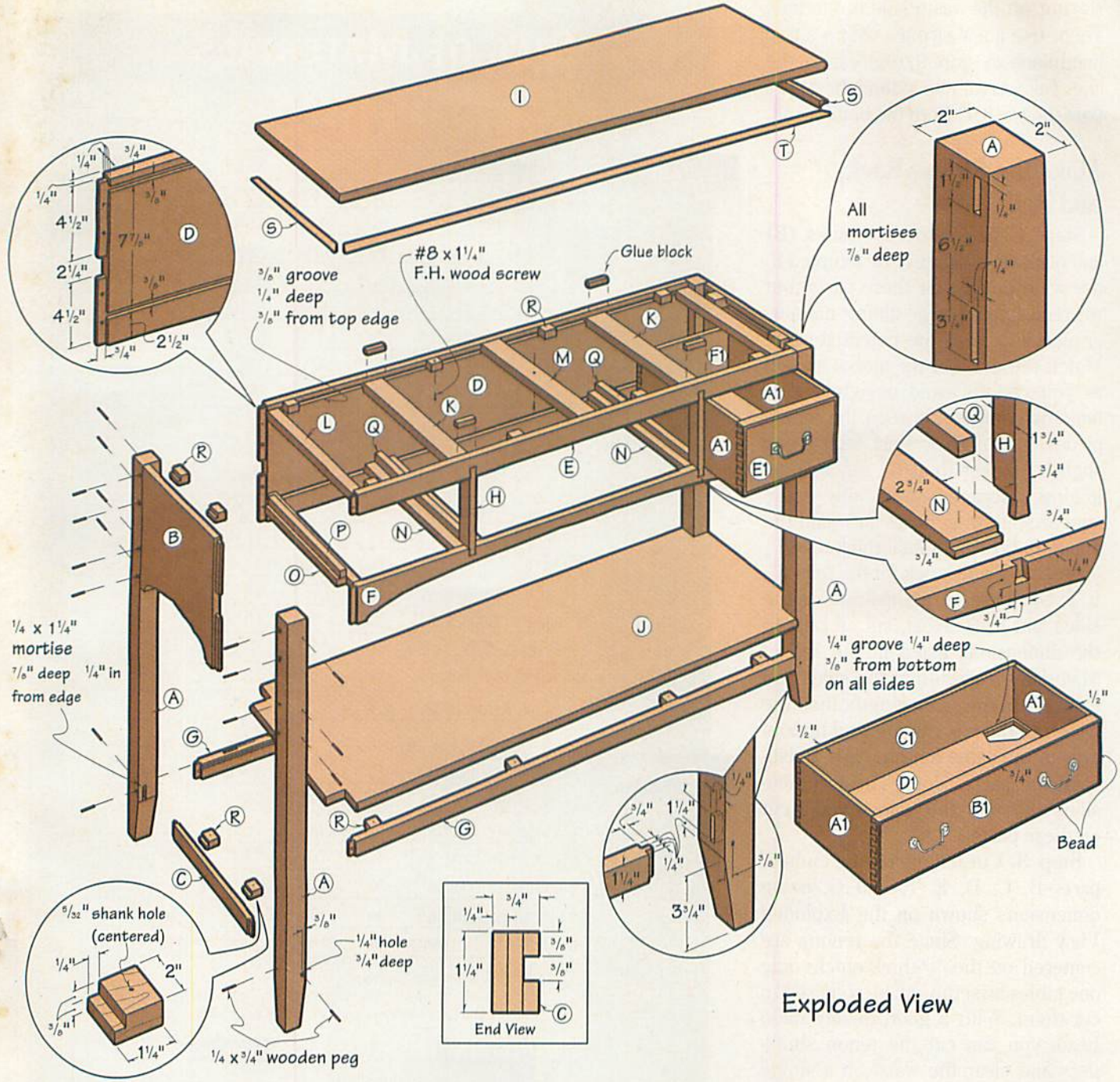
A Hard-Working Table With a Past

by David Peters

The hunt board comes down to us with a rich history. Although one source traces a form of it back to medieval England, designer Mark Ziobro patterned this version after the long table or board commonly found on plantations in the antebellum South. Usually placed outdoors near the front entry, the hunt board served as a useful depository whereupon the hunter or farmer flung his bounty. Its height, well above usual table standards, was probably intended to put the board within easy reach of riders on horseback.

In these more or less civilized times, most of us do our hunting at the supermarket. Today's hunt board has consequently migrated indoors to the hallway or kitchen, where it offers a handy elevated surface on which to fling our groceries or mail. Placed in the dining room, it will serve handsomely as a sideboard, providing storage for silver and table linens as well. Mark reports that his board now serves as a catch-all in the living room; he plans eventually to top it with a matching bookcase.

Note that our piece features several design options that make it special. We hope you'll include these details, but the piece will still stand well should you decide not to. *(See "Add Optional Details If You Wish" on* page 43.*)*


All mortises 7/8" deep
3/8" groove 1/4" deep 3/8" from top edge
#8 x 1 1/4" F.H. wood screw
Glue block
1/4 x 1 1/4" mortise 7/8" deep 1/4" in from edge
1/4" groove 1/4" deep 3/8" from bottom on all sides
Bead
6/32" shank hole (centered)
3/8"
1/4" hole 3/4" deep
1/4 x 3/4" wooden peg
End View
Exploded View

Start By Making the Legs

Step 1. Plane, rip, and crosscut four legs (A) from 10/4 stock to the dimensions listed in the Bill of Materials on *page 40*. Finish-sand the legs, then select the two with the best looking faces for the front legs, and relegate the two least desirable faces to the insides of the back legs. Now, mark each leg for position. (We penciled arrows on the top end of each leg pointing toward the two sides to be mortised.)

Step 2. Lay out the back leg mortises. A mortise-marking gauge (one with dual scribing points) works well for this. (We also cross-hatched the areas to be cut out to avoid mistakes when cutting the mortises.) At the top, each back leg requires a pair of mortises on adjacent sides to match the tenons on the ends of the back (D), and an identical pair to match the tenons on the ends of the sides (B). (For tenon dimensions, see the detail accompanying the Exploded View drawing.) Near the bottom, each leg requires 1/4 x 1 1/4" mortises starting 4" up from the bottom to match tenons on the end (C) and bottom rails (G). (See the detail on the same drawing for these dimensions.)

Step 3. Lay out and cut the mortises on both front legs, using dimensions shown on the two leg details that accompany the Exploded View drawing. (We suggest using a mortising machine or a mortising attachment on your drill press. We bored the mortises about 1/8" deeper than the tenons to avoid hydraulic compression of the glue during assembly.)

Step 4. Lay out the tapers on the bottom end of each leg as dimensioned on the Front and Side View drawings shown on *page 41*.) Roughcut the tapers on your bandsaw,

staying on the waste side of the line. Then, use a few strokes with a sharp handplane to smooth the cut to the line. Take care not to extend the tapers past the line 3¾" from the bottom end.

Make the Sides, Back, and Rails

Step 1. Make the two sides (B) and back (D). You may be tempted to use wide boards for these parts, but we recommend edge-gluing narrower pieces to minimize potential warp. Match the grain of the pieces as well as you can to avoid unsightly glue lines or contrast between the joined pieces. If possible, start with stock slightly thicker than ¾". After edge-joining, scrape away any glue squeeze-out, then plane and sand the glued-up boards to final thickness.

Step 2. Plane stock for the rails (C, E, F, G) to the same thickness as the sides and back. Next, cut all rails to the dimensions listed in the Bill of Materials, crosscutting the sides and end rails to the same length, then the back and the top, middle, and bottom rails to the same length. Now, finish-sand the parts. Note: These dimensions allow for the tenons you'll cut on these parts.

Step 3. Cut tenons on the ends of parts B, C, D, E, F, and G, using dimensions shown on the Exploded View drawing. Since the tenons are centered on the ¾"-thick stock, only one tablesaw setup will be required to cut them. With a good quality dado head, you can cut the tenon shoulders and clear the waste in a single pass. (We made test cuts on a same-sized piece of scrap and test-fitted the resulting tenon in one of the mortises. When the test tenon fit snugly, we cut all of the tenons using the same setup.)

Step 4. Use your bandsaw or coping saw to notch out the space between the tenons on the sides and back. Next, using the same tablesaw setup you used in Step 3 but standing the stock on edge this time, cut the ¼" shoulder on the top edges of the side, back, and top rail tenons. Now, chamfer the leading edges of each tenon using a chisel or small plane.

Step 5. Using a ⅜" dado head, cut grooves in the sides and back and in the top, middle, bottom, and end rails where dimensioned on the Exploded View drawing. Note: Before cutting the grooves, be sure to select and mark a "good" face on each piece. Since this surface will face outward, you'll want to groove the opposite face.

Step 6. To cut the arc along the bottom edge of the sides (B) and middle rail (F), first enlarge and transfer the gridded patterns shown on *page 42*. (We made full-sized cardboard half-patterns from each, then used them as templates to scribe the curves.) Next, saw the arcs to shape using a bandsaw or portable jigsaw, cutting just outside of the line. Then, use a spokeshave or file to smooth the arc to the scribed line.

Next, Assemble the Table Frame and Legs

Note: For this table, instead of cutting all the parts first and then assembling them, we decided to cut and

Bill of Materials

	Part	T	W	L	Mat.	Qty.
Table	A Legs	2"	2"	35¼"	M	4
	B Sides	¾"	11½"	15¾"	M	2
	C End rails	¾"	1¼"	15¾"	M	2
	D Back	¾"	11½"	53½"	M	1
	E Top rail	¾"	1¾"	53½"	M	1
	F Middle rail	¾"	3¼"	53½"	M	1
	G Bottom rails	¾"	1¼"	53½"	M	2
	H Dividers	¾"	1¾"	8"	M	2
	I Top*	¾"	19¼"	58"	M	1
	J Shelf*	¾"	18⅝"	56½"	M	1
	K Stretchers**	1⅜"	2¼"	17¼"	H	2
	L End stretchers**	1⅜"	1"	17¼"	H	2
	M Ctr. stretchers**	¾"	2½"	17¼"	H	1
	N Runners**	¾"	2¾"	17¼"	H	2
	O End Runners**	¾"	2½"	17¼"	H	2
	P End guides**	¾"	¾"	14¼"	H	2
	Q Center guides**	¾"	¾"	15¾"	H	2
	R Mounting blocks	¾"	2"	1¼"	H	24
	S End moldings	⅝"	⅝"	18⅞"	M	2
	T Front molding	⅝"	⅝"	57¼"	M	1
Drawers	A1 Drawer sides**	½"	6⅜"	17¼"	H	6
	B1 Drawer front**	¾"	6⅜"	26½"	M	1
	C1 Drawer back**	½"	6⅜"	26½"	H	1
	D1 Drawer bottom**	¼"	16¾"	26"	HP	1
	E1 Drawer fronts**	¾"	6⅜"	12"	M	2
	F1 Drawer backs**	½"	6⅜"	12"	H	2
	G1 Drawer bottoms**	¼"	11½"	16¾"	HP	2

* Parts glued up from narrow stock.

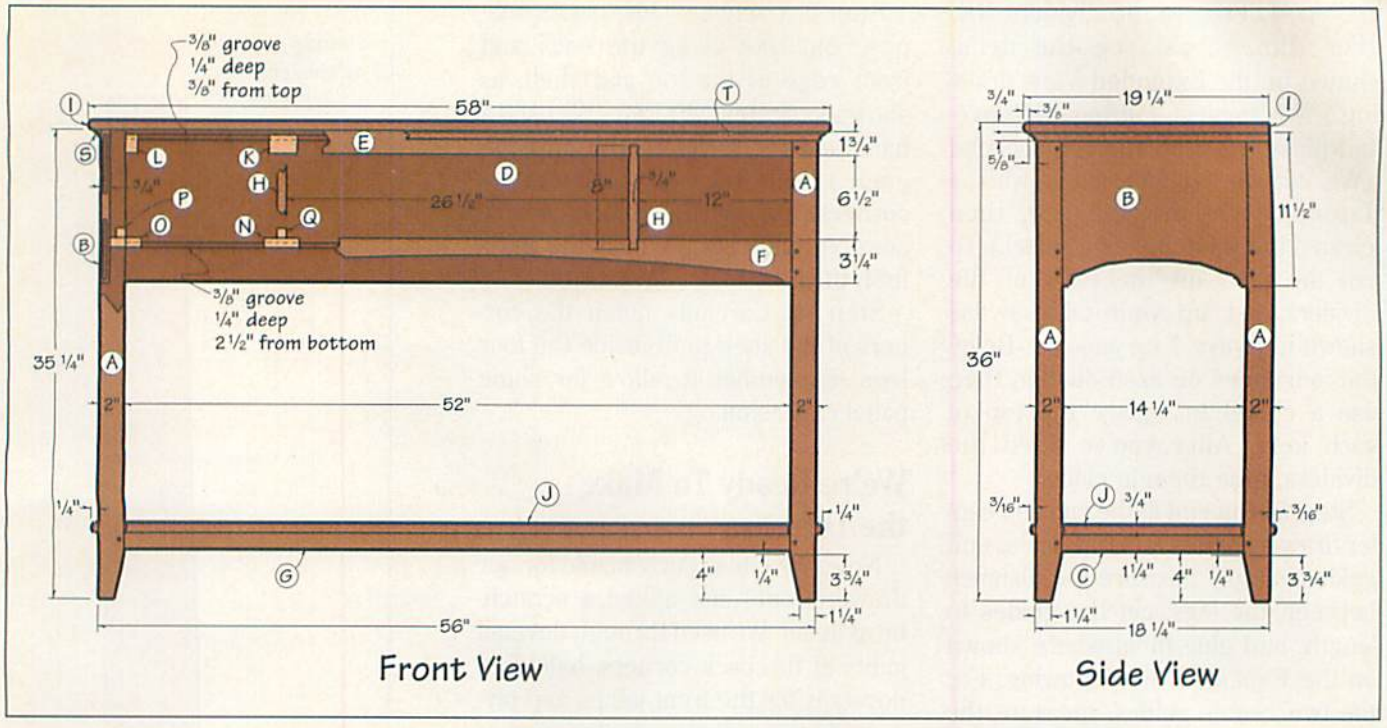
** Parts cut to final length during construction. Please read all instructions before cutting. Drawers measure 6⅜" high, ⅛" less than the opening.

Materials List

H-hardwood (we used poplar)
HP-hardwood plywood
M-Maple

Supplies

Four brass drawer pulls,
#8 x 1¼" flathead wood screws



assemble the frame and legs first. We then cut the various stretchers, runners, and guides and slid them into place. This system works well in a one-person shop, and it requires fewer clamps. However, you won't be able to glue the stretchers and runners (K, L, M, N, O) into their respective grooves in the normal way, so to compensate, we added small glue blocks to strengthen these joints. (See the Exploded View.)

Note: We'll cut the dovetail sockets in the top and middle rails for the dividers (H) after assembling the table frame. However, we recognize that it may be awkward for you to chop out the dovetail sockets at that time. As an alternative, you can dry-assemble the table now (steps 1, 2, and 3 *below*), mark the divider dovetail locations and their corresponding sockets in the front rails, then disassemble the table and cut the sockets.

Step 1. Glue, assemble, and clamp the two ends, including one front and one back leg (A), a side (B), and an end rail (C) in each assembly. Coat the tenons and their respective mortises with glue, but don't use so much that it produces excessive squeeze-out. A proper amount of glue should cause just a few beads to be forced out as you apply clamp pressure.

Step 2. Check the assemblies for squareness by measuring diagonally from corner to corner (measurements should be equal). Check for flatness as well, and make any necessary adjustments. Note: These end assemblies must be square, or you'll have a difficult time getting the rest of the table to fit properly.

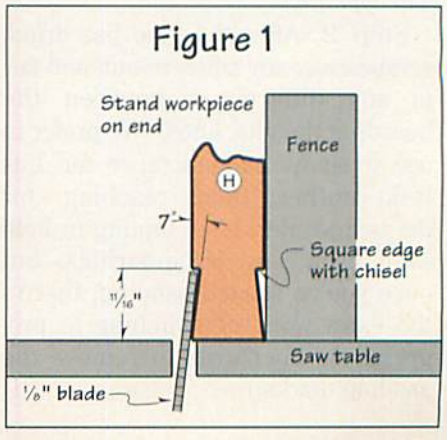
Step 3. Glue, assemble, and clamp the ends to the back and the top, middle, and bottom rails. Measure diagonally across the top and the front to check for squareness. Note: If your pipe clamps aren't long enough to reach the length of the table, simply screw a coupling onto the pipe ends, then screw another pipe into the coupling for extra length.

Now, Cut and Fit the Remaining Frame Parts

Step 1. Measure the table width and cut the stretchers (K, L, M) and runners (N, O) to size, adding ½" to the overall length for the grooves. To make parts K and L, you can use thick stock and plane or resaw it to the 1⅜" thickness, or laminate thinner pieces face to face and then surface them to correct thickness. (We used a wooden extension and stop-block on our tablesaw's miter gauge to cut same-length parts.) Next, cut rabbets (to form tongues) on the ends of the stretchers and runners to fit into the grooves in the back and the top and middle rails. Also, notch the end runners (O) to fit around the legs.

Step 2. Fit the stretchers and runners into the frame. To do this, slightly spring out the top and middle rails just enough near the table center to insert the ends of the stretchers and runners into the grooves. Next, slide the parts into their proper positions, and square them to the table front. Note: Center the stretchers (K) and runners (N) behind the drawer dividers; place parts L and O against the legs.

Step 3. From scrap, cut about 20" of ⅜x⅜" blank and crosscut glue blocks from it. (We cut the blocks to lengths that match the widths of the pieces they anchor.) Glue a block on top of each stretcher at each end where shown on the Exploded View drawing. Next, cut a 20" length of ¾x¾" blank from scrap, then cut glue blocks from it and glue them to the undersides of the runners (N, O.)



Step 4. Prepare the dividers (H). (For dimensions, see the detail shown on the Exploded View drawing.) We suggest cutting the dovetail pins first, then the rail sockets. (We cut the socket sides with a Japanese-style dovetail saw, then cleared the waste using a chisel.) To cut the pins on the ends of the dividers, set up your tablesaw as shown in *figure 1* on *page 41*. Bevel the four faces on each divider, then use a chisel to square the top of each kerf. After you've fitted the dividers, glue them in place.

Step 5. Cut and fit the end and center drawer guides (P, Q). For the end guides, simply measure the distance between the legs, cut the guides to length, and glue them where shown on the Exploded View drawing. For the two center guides, measure the distance between the drawer divider and the back. Then, cut the guides to fit, and glue them in place.

Edge-Glue Stock For the Top and Shelf

Step 1. To make the top (I) and shelf (J), start by ripping and jointing sufficient stock, taking care to select material with consistent grain and color. If you like, select a strip with curly maple for the front edge of both parts. After you've applied glue to the mating edges of the stock, apply plenty of bar clamps to exert uniform side-to-side pressure, using waxed clamp cauls across the glue-up (both top and bottom) to keep everything flat and aligned. Apply moderate clamp pressure to the panel edges, but be careful not to squeeze out all of the glue. (For more suggestions on edge-joining panels, see the Pro Tip *opposite*.)

Step 2. After the glue has dried, scrape away any squeeze-out, and fair in any differences between the boards at the glue lines. (We prefer to use a sharp hand scraper for this task, rather than reaching for the belt sander. It's tempting to belt-sand away any irregularities, but once you've started sanding, there's the extra work of switching to progressively finer grits to remove the sanding marks.)

Step 3. Using a ¾" half-radius bullnose bit, rout along the ends and front edge of the top and shelf, as shown in *figure 2 opposite*. (We used a handheld router fitted with an edge guide.) Note: To avoid tear-out at the corners, use backing blocks where possible, and always rout the ends first, then the long edges.

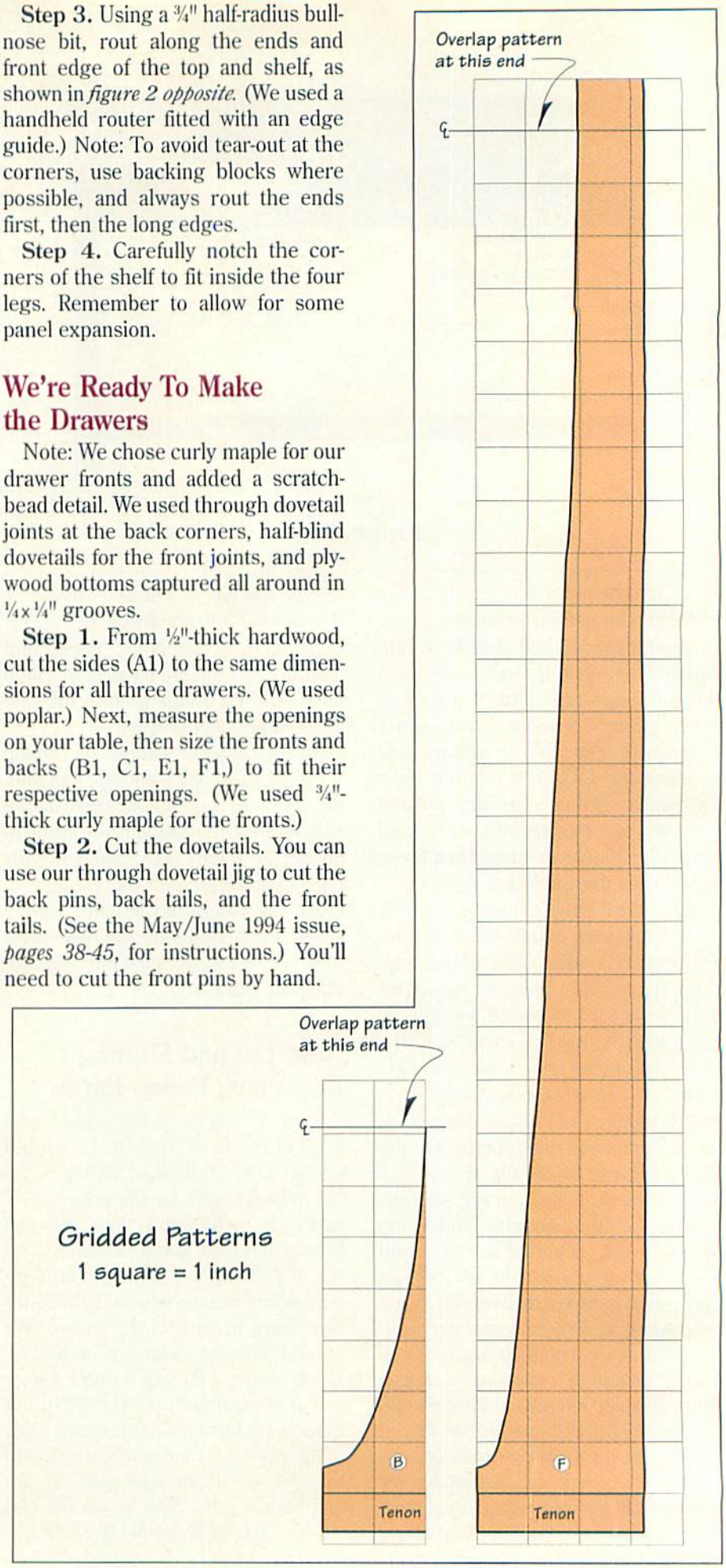
Step 4. Carefully notch the corners of the shelf to fit inside the four legs. Remember to allow for some panel expansion.

We're Ready To Make the Drawers

Note: We chose curly maple for our drawer fronts and added a scratch-bead detail. We used through dovetail joints at the back corners, half-blind dovetails for the front joints, and plywood bottoms captured all around in ¼ x ¼" grooves.

Step 1. From ½"-thick hardwood, cut the sides (A1) to the same dimensions for all three drawers. (We used poplar.) Next, measure the openings on your table, then size the fronts and backs (B1, C1, E1, F1,) to fit their respective openings. (We used ¾"-thick curly maple for the fronts.)

Step 2. Cut the dovetails. You can use our through dovetail jig to cut the back pins, back tails, and the front tails. (See the May/June 1994 issue, *pages 38-45*, for instructions.) You'll need to cut the front pins by hand.



Step 3. Cut grooves for the bottom panels along the bottom edge of each drawer part where shown on the Exploded View drawing. To avoid leaving an open slot at the back end of the drawer sides, you can either cut this groove blind or simply cut scrap plugs to fill the openings after assembling the drawers. Next, round over the top edges of each drawer side and back. (We used a ¼"-radius round-over bit.)

Step 4. Dry-assemble the drawers, then fit them into their openings. Measure the drawer interiors, and add 7/16" to these dimensions to figure widths and lengths for the bottoms. Now, cut the three bottoms (D1, G1) to size from ¼"-thick hardwood plywood.

Step 5. If you wish to bead the drawer front edges, see "Creating the Decorative Bead on the Drawer Fronts" (Jan./Feb. 1995, *page 51*) for instructions. You can also purchase a hand-beading tool (made by Veritas) to do this. (We found that this tool works well when cutting with the grain, but on cross-grain cuts, we scored the cutlines first with a sharp knife to avoid tearing the wood fibers.)

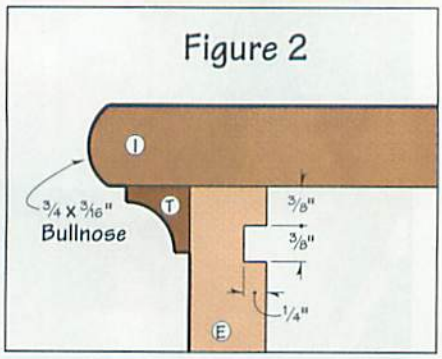
Step 6. Glue, assemble, and clamp the drawers. (We allowed the bottoms to float freely in their grooves.) Check each drawer for squareness, and adjust the clamps if necessary. After the glue has dried, sand the joints flush.

Add Optional Details If You Wish

Pegs. Before glues were perfected, craftsmen used tenon pegs to lock their joints together. Although it's tempting to think that they still add strength to the construction, with today's modern adhesives (and assuming that you've cut tight-fitting mortises and tenons), the pegs now provide mostly decorative detail.

To add the pegs, first drill 7/32" holes as deep as you want the pegs to go. (We positioned the holes 3/8" in from the edges and roughly centered them on the tenons as shown on the Exploded View drawing.) Next, cut several 12"-long, ¼"-square blanks for the pegs. To make a peg, mark the depth of the peg hole on the edge of the stock, then knock off the corners

Figure 2



with a chisel. Round and taper most of the peg, but leave the visible end square. Put a drop or two of glue on the tapered end, drive it into a hole, and then cut it off to about 1/16" long with a backsaw. Now, using a chisel, bevel each peg corner toward the center, leaving it slightly proud.

Hardware. We used solid brass drawer pulls. (See our Sources list if you wish to purchase the same pulls we used.) Next, position the pulls on the drawers where dimensioned on the Side Drawer and Center Drawer drawings *below.* Mark the screw-hole centerpoints, then drill 1/16" pilot holes 3/8" deep.

Now, For the Final Assembly

Step 1. As the Exploded View shows, we use mounting blocks (R) to hold the top and shelf in place. The rabbeted edges on these blocks fit into the grooves you cut in the table frame parts. Cut 24 blocks to the dimensions shown on the block detail. Then, drill a 5/32" shank hole through the center of each block.

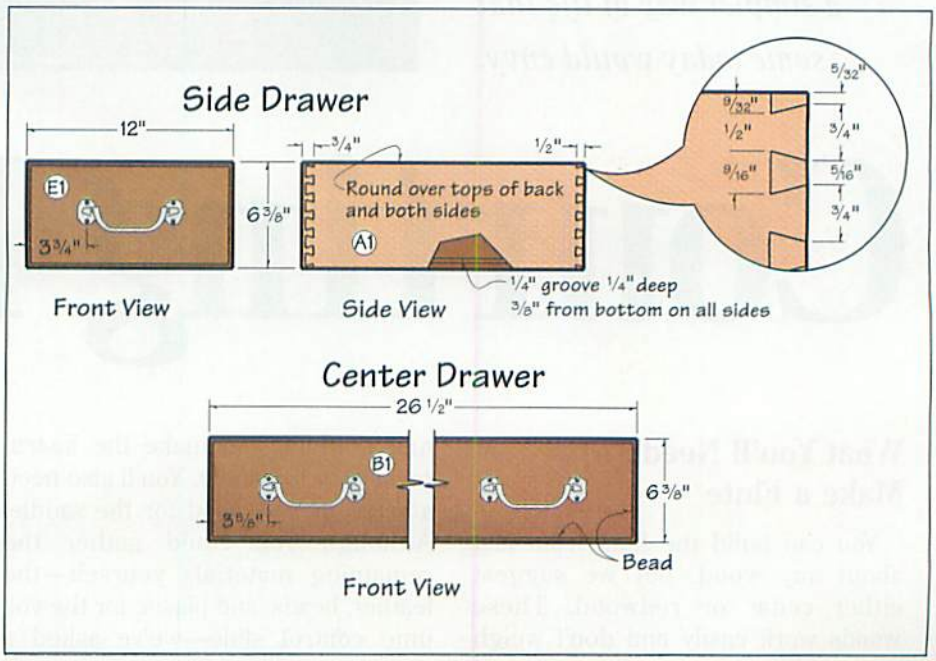
PRO TIP

Edge-joining panels can be a *hassle.* If you're tired of fussing with C-clamps and bars to keep edge-glued panels flat, you may want to invest in a set of heavy-duty edge clamps, which apply edge pressure and keep the panels flat at the same time. (To order a kit for making serviceable edge clamps, see the Sources list at the end of the article.) Installing biscuits, splines, or dowels along the mating edges of the pieces also helps keep them aligned during clamping.

Step 2. Attach the top and shelf. To do this, place the top upside down on a flat surface, then lay the table on it, centering it from end to end and aligning the back edges. Position the mounting blocks, then use the shank holes as guides to drill pilot holes in the top. Finally, drive a #8 x 1¼" flathead wood screw through each block and into the top, and two screws through the center stretcher to anchor the center of it to the top. To attach the shelf, temporarily clamp it in place, then use the same procedure to mount it.

Step 3. To make the decorative cove molding (S, T), cut a 5/8 x 1½ x 60" blank. Then, using a ½"-radius cove bit, rout both edges of the blank as shown in *figure 3* on *page 53.* Rip the two 5/8"-wide strips from the blank.

continued page 53



An Instrumental Tie To An Old Native American Tradition

According to legend, young Lakota braves used this flute to court eligible young women. We think you'll find that the haunting sounds produced by David Moretti's easy-to-make version evoke not only the wide-open spaces of the Great Plains but also a simpler way of life that some today would envy.

Courting Flute

What You'll Need To Make a Flute

You can build the flute from just about any wood, but we suggest either cedar or redwood. These woods work easily and don't weigh much, which will make the instrument easy to handle. You'll also need a scrap of hardwood for the saddle. Although you could gather the remaining materials yourself—the leather, beads, and plastic for the volume control slide—we've asked a mail-order supplier to assemble a kit that includes these items. (See the Kit Source on *page 65.*) To make the flute, you'll first rout a cavity in each of two blanks, glue the blanks together, then turn this assembly on the lathe to make it cylindrical.

Start By Making Two Blanks

Step 1. From ¾"-thick stock, cut a pair of 1⅜ x 24½" blanks. (We selected clear, straight-grained redwood and oversized the blanks to provide an extra 1" at the mouth end and 1½" at the open end.)

Step 2. Mark the centerpoints for the six finger holes and the two air holes on the top blank, using dimensions shown on the Flute Blank Layout drawing at *right*. Next, lay out the interior wall and the two cavity chambers on the bottom blank. Then, transfer that layout to the top blank, taking care to make the layouts identical on both blanks, since they must match up perfectly when joined.

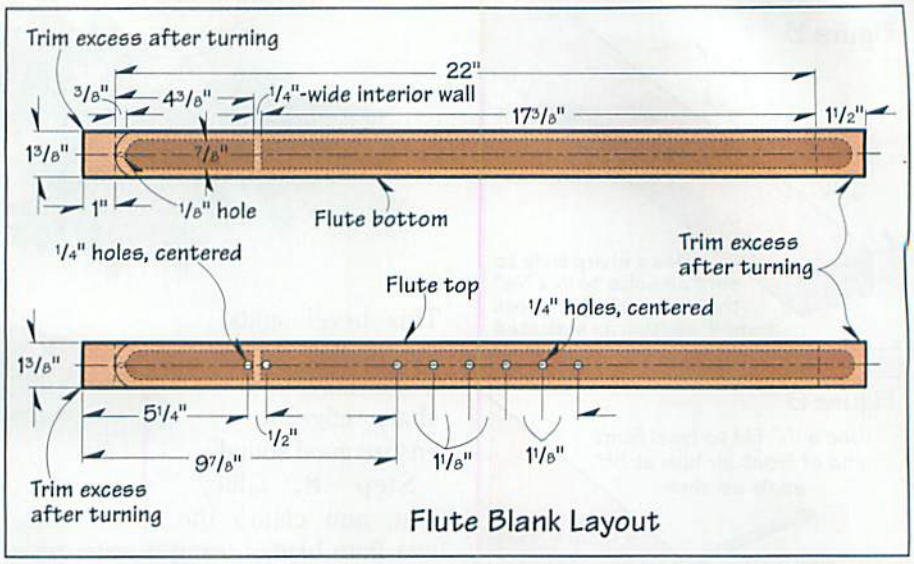
Step 3. Fit your table-mounted router with a ¾"-diameter core-box bit set to cut ⅜" deep. As shown in *figure 1*, mark the profile of the bit on the router-table fence, then use these lines as guides to start and stop the stock at the limits of the two chambers. For the first pass, set the fence ⅝" from the bit's centerpoint. Rout both chambers in each blank, taking care not to get too close to the interior wall that separates them. Then, reset the fence ¾" from the bit's centerpoint as shown in *figure 2*, and rerout the cavities in both blanks to make them ⅞" wide.

Step 4. Using a sharp chisel (a skew works best) and a gouge, square off the rounded end of each chamber to form the ¼"-thick wall. (See *figure 3*.) Note: Avoid using a straight chisel for this; you'll risk cutting too deeply, which could create an unplanned hole in the flute later when you turn it round on the lathe.

Step 5. Drill the finger holes and the air holes through the top flute blank where marked and as shown in *figure 4*. To avoid chip-out when the drill bit breaks through, back the blank with a large-diameter dowel or scraps of wood cut to fit inside the cavity. Also, lay out the 4"-long section surrounding the air holes where dimensioned on the same drawing.

Step 6. With a sharp knife, shape the two air holes to the dimensions shown on *figure 5*. Next, using a chisel, remove about 1/16" of stock to flatten the 4"-long area surrounding the air holes. This area must be flat so the volume-control slide and saddle can sit on it.

Step 7. Using a fine, flat ¼"-wide file, create a 35° bevel on the front end of the front air hole. (See *figure 6*.)



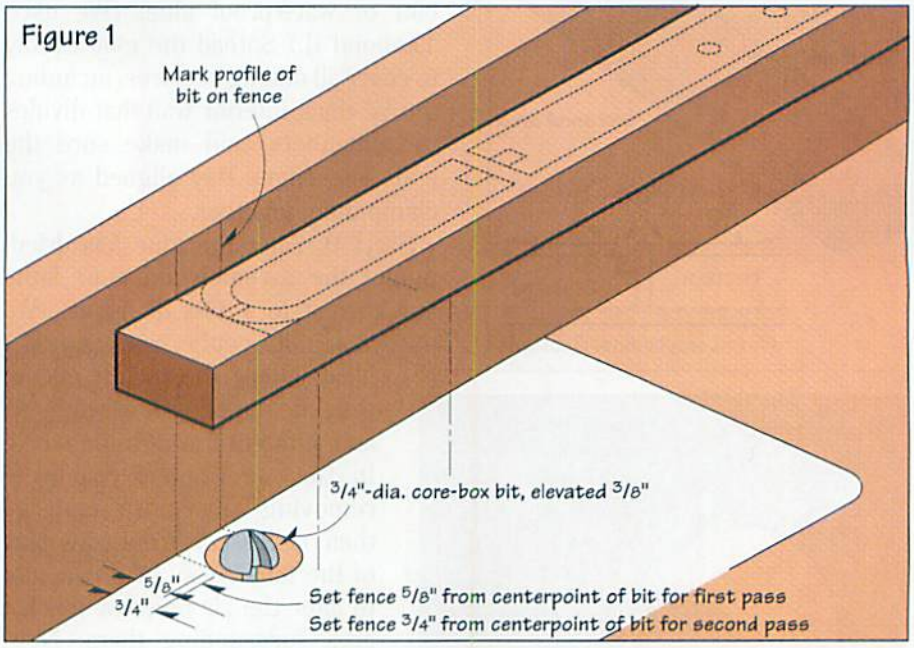
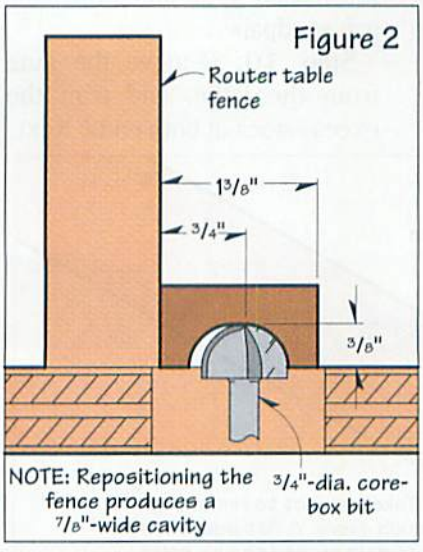
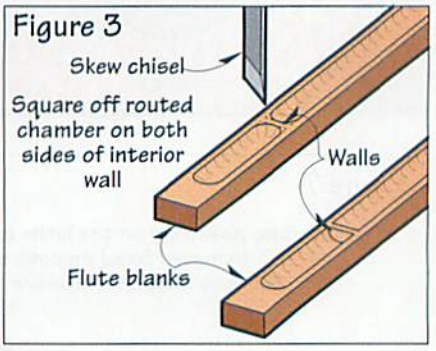


Figure 1
Mark profile of bit on fence
3/4"-dia. core-box bit, elevated 3/8"
5/8"
3/4"
Set fence 5/8" from centerpoint of bit for first pass
Set fence 3/4" from centerpoint of bit for second pass





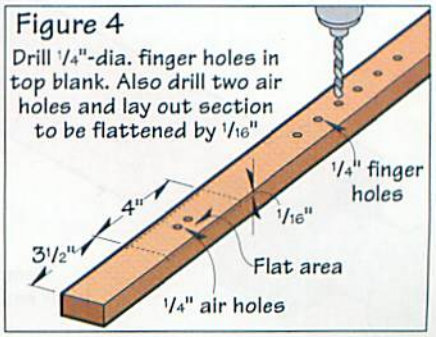


Figure 4
Drill 1/4"-dia. finger holes in top blank. Also drill two air holes and lay out section to be flattened by 1/16"
1/4" finger holes
4"
1/16"
3 1/2"
Flat area
1/4" air holes

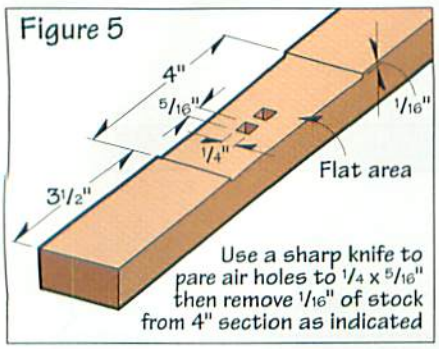
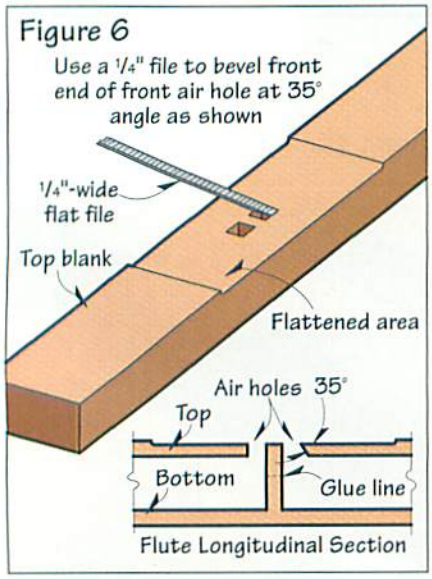
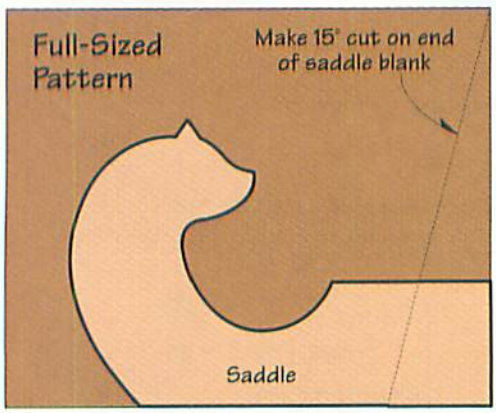


Figure 5
4"
5/16"
1/4"
1/16"
3 1/2"
Flat area
Use a sharp knife to pare air holes to 1/4 x 5/16" then remove 1/16" of stock from 4" section as indicated





This bevel splits the air flow, so file it carefully to a sharp edge to ensure good sound.

Step 8. Glue, join, and clamp the two flute blanks using a water-resistant or waterproof glue. (We used Titebond II.) Spread the glue evenly to cover all mating surfaces, including the ¼"-thick interior wall that divides the chambers, and make sure the ends and edges stay aligned as you clamp them together.

Step 9. After the glue has dried, mount the assembly on your lathe and turn it to a 1⅜" diameter. (We used a spindle gouge. See *figure 7.*) Next, shape the mouth end of the flute, tapering it carefully so as not to cut through the stock. In fact, we suggest you avoid removing any more material than necessary from any part of the flute. Also, take care not to alter the air holes or the flat area surrounding them. Now, finish-sand your flute with 220-grit sandpaper.

Step 10. Remove the flute from the lathe, and trim the excess stock at both ends. Next, drill a ⅛" hole through the mouth end. (For help with this step, see our Pro Tip *opposite*) Now, finish-sand the ends of the flute. Note: Since you made two separate passes with the core-box bit, the flute's cavity won't be perfectly round. This won't affect the instrument's performance, but for the sake of appearance, you may want to sand the cavity round at the open end.

Make the Saddle and Slide, Then Add Finish

Step 1. To make the saddle, first cut a ½ x 2 x 2½" blank. (We used boxwood.) Transfer the full-sized Saddle pattern shown at *left* onto the blank, then angle-cut one end to 15° where shown on the pattern.

Step 2. Fit your table-mounted router with a ¼" straight bit, elevate it to cut ¼" deep, then rout the air-control slot as shown in *figure 8.* Next, band- or scrollsaw the saddle

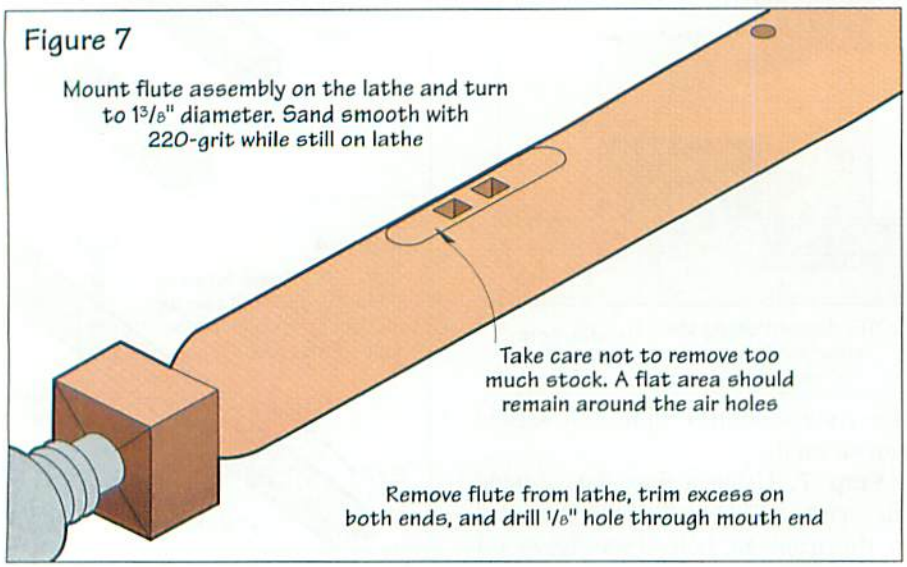
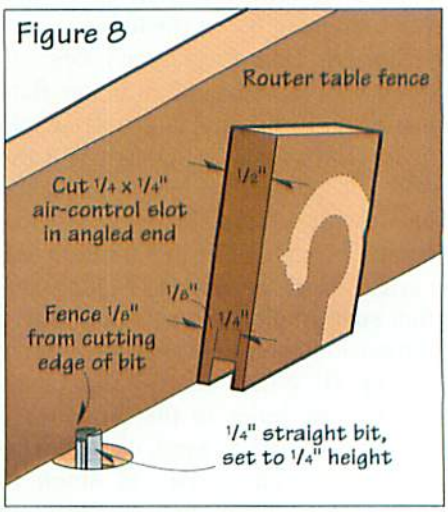


Figure 7
Mount flute assembly on the lathe and turn to 1 3/8" diameter. Sand smooth with 220-grit while still on lathe
Take care not to remove too much stock. A flat area should remain around the air holes
Remove flute from lathe, trim excess on both ends, and drill 1/8" hole through mouth end



to shape, and finish-sand the piece. Note: Use the inset close-up flute photo *above* as a guide for shaping the saddle.

Step 3. Make the volume-control slide dimensioned in *figure 9* from a 1/32"-thick strip of fairly stiff plastic. (The hardware kit includes a plastic blank for this purpose.) Use a sharp utility knife to cut the opening and trim the slide to final size.

Step 4. Apply your choice of finish. (We sprayed the flute and saddle with three coats of Deft aerosol lacquer, rubbing each coat after it had dried with 0000 synthetic steel wool.)

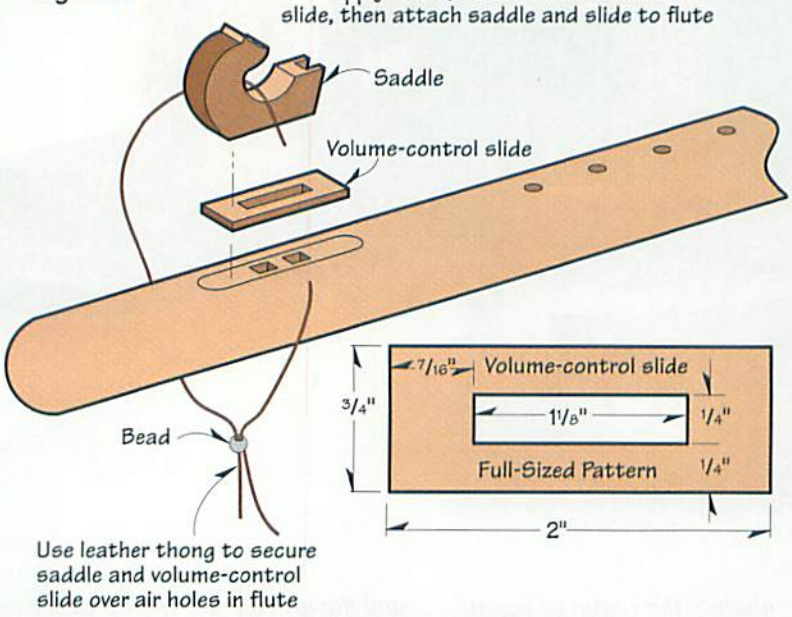
Step 5. When the final finish coat has dried, use one of the leather thongs to attach the saddle and slide. (See *figure 9.*)

Tie a knot in the thong, making it tight enough to hold the saddle and slide snugly against the flat area around the air holes. Add the decorative thong to the open end of the flute, then knot a couple of decorative beads onto the ends of both thongs.

Step 6. Now, adjust the position of the saddle and volume-control slide to achieve the desired musical tone and volume. As shown in *figure 10*, you'll

continued on page 65

Figure 9



PRO TIP

To drill a centered, perpendicular hole in the mouth end of the flute, we suggest using the jig shown *below.* To make it, cut a piece of scrap stock to 2 x 2 x 3", then draw diagonal lines from the corners to find the center on one end. Using a Forstner bit in your drill press, bore a centered, 1⅜" hole 2" deep in one end of the block. (The flute, after turning and sanding, should fit snugly but not tightly in a hole of this size.) Next, flip the block end for end, and using a ⅛" brad-point bit, drill a centered hole through to the larger hole. Now, insert the mouth end of the flute into the jig, and using the small existing hole in the jig as a guide, drill a ⅛" hole through the flute. (We used our portable drill and a brad-point bit for this.)

Hole-Drilling Jig

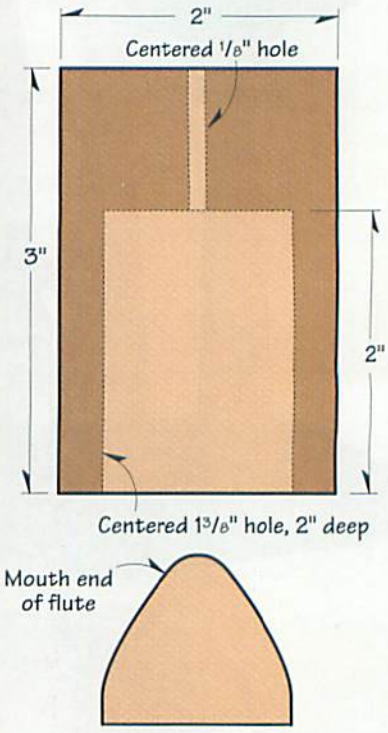
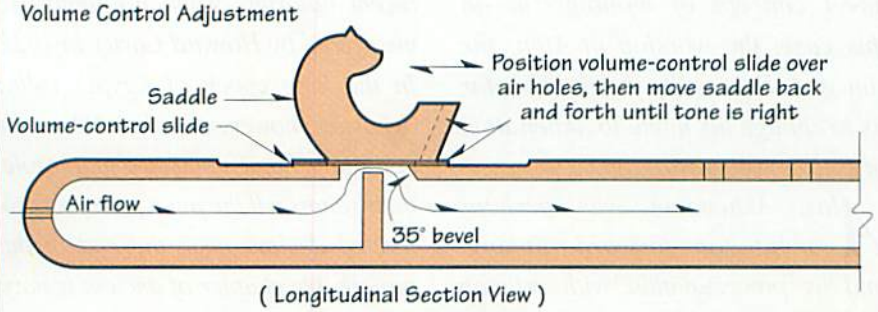
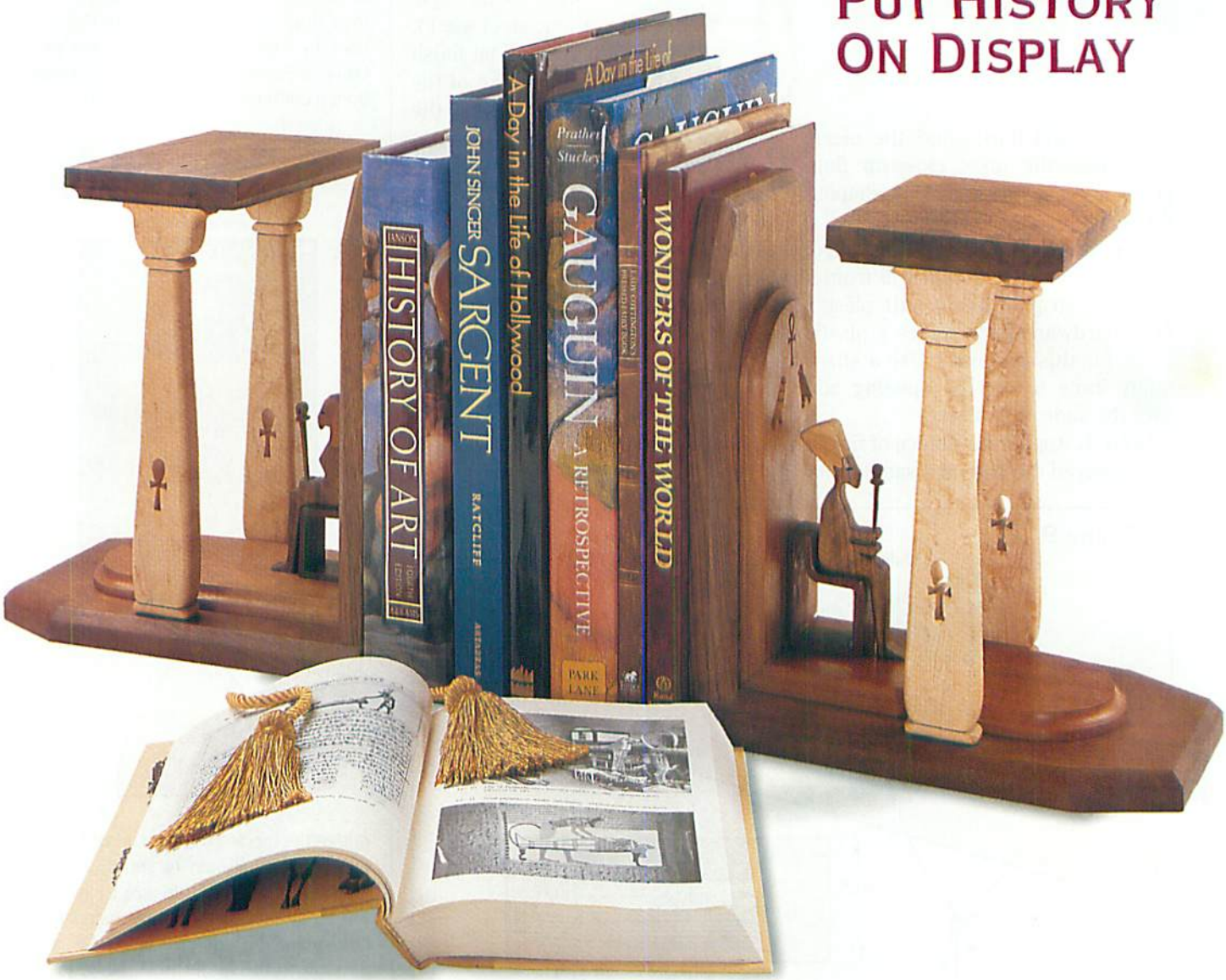


Figure 10


Volume Control Adjustment
Position volume-control slide over air holes, then move saddle back and forth until tone is right
Saddle
Volume-control slide
Air flow
35° bevel
(Longitudinal Section View)

EGYPTIAN BOOKENDS

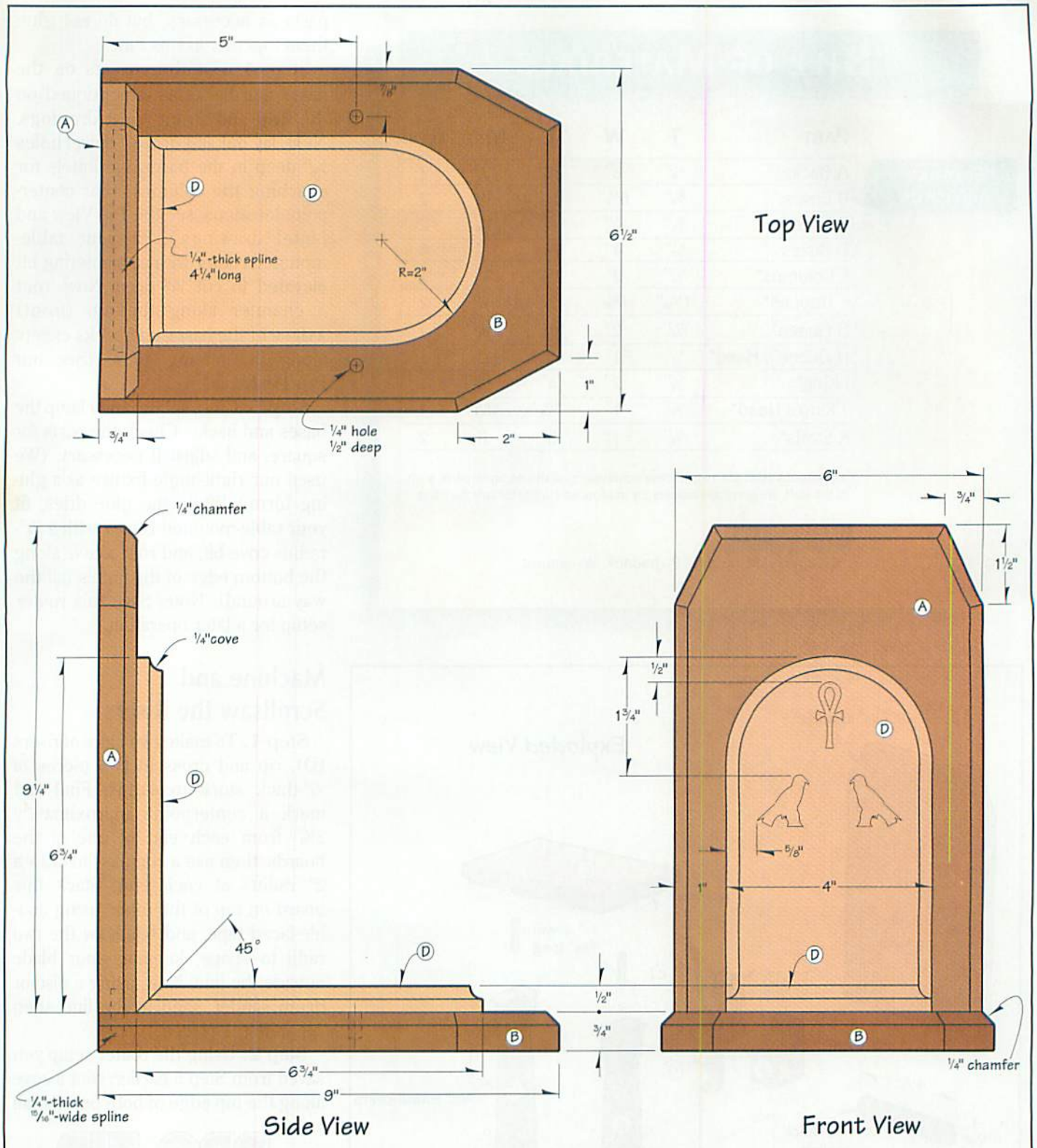
PUT HISTORY ON DISPLAY



If you're a devotee of ancient history and of the scrollsawyer's art, these striking curios will satisfy both interests and probably mystify all passersby. We're not sure just which Egyptian monarchs Bill Zaun had in mind when he designed them, but we'll presume that the queen is Nofretete (or Nefertiti), which would make the king her husband, Amenhotep IV (ruled 1379-1362 B.C.). Nofretete's fame, like her beauty, inhabits the realm of legend, but her lesser-known husband figured more tangibly in the historical record. He tried to enforce the novel concept of monotheism—in this case, the worship of Aton, the sun god. Eventually, he went so far as to change his name to Akhenaton, or "All is well with Aton."

Alas, Akhenaton was perhaps a bit too forward-thinking, and his preoccupation with religion and the arts left the empire weakened. His successor, Tutankhamen, restored the old ways—much to the relief of the priest class—and achieved relatively recent notoriety when his tomb was uncovered by Howard Carter in 1922. In the long epoch of Egypt's ruling dynasties, however, neither Akhenaton nor Tutankhamen played a major role; their reigns fell during a period of protracted decline near the end of this remarkable chapter of ancient history.

Books courtesy of Waldenbooks, Northwoods Mall, Peoria, IL



Make the Bases, Backs, and Lintels

Step 1. From ¾"-thick stock, rip and crosscut two backs (A), two bases (B), and two lintels (C) to the dimensions listed in the Bill of Materials. (We selected walnut for these parts.)

Step 2. Rout a stopped groove in the bottom end of each back (A) and in the top face of each base (B) to accept the spline. (See the Top and Side View drawings *above*.) To do this, fit your table-mounted router with a ¼" piloted slotting cutter, and elevate it so that its bottom edge clears the table by ¼". (For help with these grooves, see "Routing the Stopped Grooves" on *page 51*. To order a slotting cutter, see our Sources list.)

Step 3. Cut a pair of splines from ¼"-thick plywood or hardboard. Size them to match the actual depth and length of your grooves, and shape the ends of the splines to match the radius at the ends of the grooves. (We made our splines 15/16" wide to allow a bit of glue space.) Now, dry-assemble the bases, backs, and splines to make sure that everything fits. Adjust the

Bill of Materials

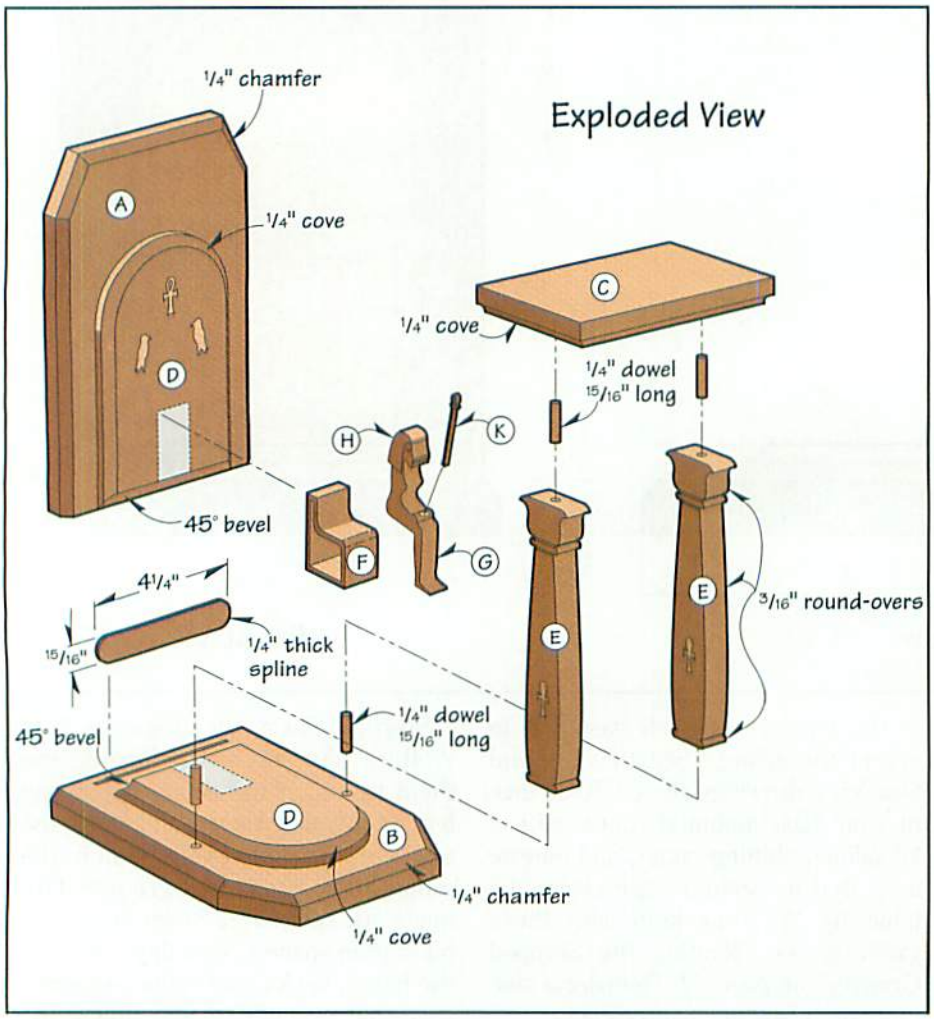
Egyptian Bookends

Part	T	W	L	Mat.	Qty.
A Backs	¾"	6"	9¼"	W	2
B Bases	¾"	6½"	9"	W	2
C Lintels	¾"	4"	6"	W	2
D Risers	½"	4"	6¾"	C	4
E Columns*	¾"	2"	7½"	M	4
F Thrones*	1 1/16"	1⅜"	2"	P	2
G Queen*	½"	2"	3¾"	W	1
H Queen's Head*	½"	1"	1¼"	C	1
I King*	½"	2"	4"	W	1
J King's Head*	½"	1"	1¼"	M	1
K Staffs*	¼"	1"	3"	P	2

*Dimensions listed are initial (before scrollsawing to shape). Some parts, such as the staff, are oversized deliberately to allow handholds for safe handling.

Materials List

C–cherry, M–maple, P–padauk, W–walnut



parts as necessary, but do not glue them together at this time.

Step 4. Cut the corners on the bases and backs as dimensioned on the Top and Front View drawings. Next, lay out and drill ¼" dowel holes ½" deep in the bases and lintels for attaching the columns. (For centerpoint locations, see the Top View and Lintel drawings.) Fit your table-mounted router with a chamfering bit elevated to cut ¼" deep. Now, rout a chamfer along the top (front) edges of the bases and backs except along the mating ends. (See our Pro Tip *below*.)

Step 5. Glue, spline, and clamp the bases and backs. Check the parts for square, and adjust if necessary. (We used our right-angle fixture as a gluing form.) While the glue dries, fit your table-mounted router with a ¼"-radius cove bit, and rout a cove along the bottom edge of the lintels (all the way around). Note: Save this router setup for a later operation.

Machine and Scrollsaw the Risers

Step 1. To make two pairs of risers (D), rip and crosscut two pieces of ½"-thick stock to 4×14". Find and mark a centerpoint approximately 2⅛" from each end of one of the boards, then use a compass to draw a 2" radius at each end. Stack this board on top of the other using double-faced tape, and bandsaw the two radii to shape, keeping your blade outside the line. Now, using a disc or drum sander, sand to the line, then separate the pieces.

Step 2. Using the router setup you saved from Step 5 earlier, rout a cove along the top edge of both boards (all

PRO TIP

As with any router molding work, we recommend "chasing the edges." To do this, rout one end of the board first, then rotate the board counterclockwise on your table, routing an edge, then an end, then the final edge. This approach ensures that the edge cuts will clean up any end-grain chip-out.

the way around). Crosscut the boards in half, then tilt your tablesaw blade to 45° from perpendicular. (We verified this angle using an angle gauge.) Now, bevel-cut each riser to a finished length of 6¾", and finish-sand the top face of each.

Step 3. Transfer the full-sized "ankh" and hawk patterns shown on *page 52* to each riser, positioning them where shown on the Exploded View drawing. (We centered the ankh and located its top ½" down from the top of the radius. We positioned each hawk with its head 1¾" from the top of the radius and its tail ⅝" in from the edge of the riser.)

Step 4. Drill 3/64" start holes where shown on the patterns. Next, scrollsaw the ankhs and hawks to shape, keeping your blade centered on the line. (We used a no. 4 jeweler's blade, which we bought from our local jeweler's supply. To order such blades, see our Sources list.) Save the cut-out pieces, and sand them—except for the interiors of the ankh loops—to a thickness of ⅜".

Step 5. Glue and clamp a pair of risers to each base/back assembly. While the glue dries, glue the inset ankhs and hawks into their respective cutouts, including the ankh loop interiors.

Fashion the Columns and Thrones

Step 1. Crosscut the ¾"-thick stock for the four columns to its finished length of 7½". (We used bird's-eye maple.) Transfer four copies of the full-size Column pattern shown on *page 52*, then drill a centered ¼" dowel hole ½" deep in both ends of each column where indicated. (We secured a tall fence to our drill-press table, then clamped our stock to it and set the quill depth. You can also use a doweling jig and depth-stop collar with your portable drill.)

Step 2. Drill a start hole inside the ankh in each column, then scrollsaw the ankh to shape, keeping your blade centered on the line. Next, scroll- or bandsaw each column to shape, keeping your blade outside the line. (We used a 1/16" blade on our bandsaw.) Fit your table-mounted router with a 3/16"-radius round-over bit, and rout all edges of the columns except for the top ends. Use sandpaper to round those edges you can't reach with the router.

Step 3. Turn each column on edge, and carefully bandsaw a 1/16"-deep kerf on both faces and around the corners at the three points of segmentation shown on the pattern. (We used a miter gauge on our bandsaw table to help steady the workpiece.) Next, remove the patterns, and finish-sand the columns.

Step 4. To make the two thrones, first cut a 1½x4" piece of 1/16"-thick stock. (We used padauk.) Transfer two copies of the full-sized Throne pattern shown on *page 52* to one face, aligning the bottom and back of each with one end and edge of the workpiece. (This will ensure that each throne will fit squarely into the right angle formed by the two risers.) Drill start holes, then scrollsaw the interior of each throne, keeping your blade inside the line. Now, scrollsaw the exterior profile, and then finish-sand both thrones.

Routing the Stopped Grooves

To limit the length of the mating spline grooves, use a tall fence on your router table, and clamp stopblocks to it. You'll need to reposition the stopblocks to rout the second of these two pieces, since the back and base differ in width. For both grooves, however, keep the bottom edge of the slotting cutter set ¼" above the table. Position your fence so that its face is flush with the pilot bearing.

To cut the groove in the base, stand the piece on end. Clamp a pair of stopblocks to the fence, each equidistant from the center of the router shaft. To find this center, chuck a pointed rod in the router collet. Some woodworkers keep such a rod handy for this purpose, although a countersinking bit will also suffice.

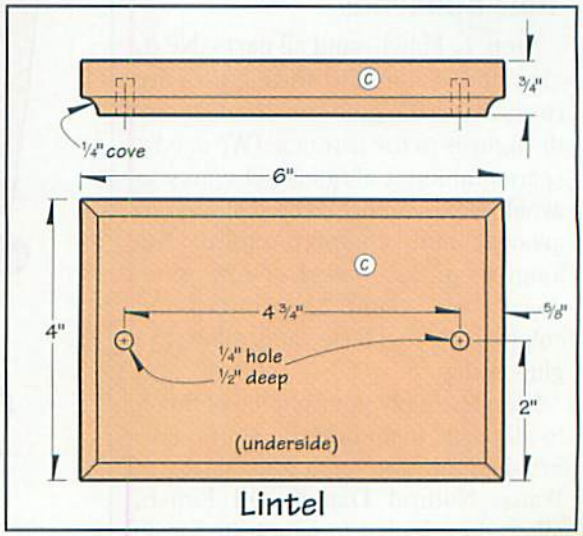
If you're using a standard 1⅜"-diameter slotting cutter, position each stopblock 4 7/16" from the bit's centerpoint (to create a 4¼"-long slot). Stand the base on end, and clamp it to a right-angle support to lend the necessary stability. Starting with the workpiece against the right stopblock, ease it into the cutter, then slide it along the fence until it contacts the left stop. (Note: Make sure you advance the stock from right to left, against the counterclockwise cutter rotation. If you advance it in the opposite direction, the cutter can grab the stock and pull it out of your hands.) Rout the second base piece the same way.

Lay each back piece flat on the table to rout its spline groove. Since the backs are narrower than the bases, position your stopblocks 4 3/16" from the router bit's centerpoint. After routing this groove, check the back against the base to make sure that the two grooves match in length and align perfectly.

Make the King, Queen, Headdresses, and Staffs

Step 1. Transfer the king and queen patterns shown on *page 52* to a 2x8" piece of ½"-thick stock. (We selected walnut.) Next, drill a 3/64" start hole in each eye, then carefully scrollsaw the eyes to shape, keeping your blade centered on the line. (Again, we used our no. 4 jeweler's blade.)

Step 2. To cut the figures and headdresses in one operation, first cut a 2x4" piece of ½"-thick contrasting stock for each headdress. (We used maple for the king's and cherry



for the queen's. This approach also ensures a snug joint between parts.) Lay these two pieces end to end, then stack the 2x8" workpiece on top of them using double-faced carpet tape. Next, scrollsaw the figures and headdresses to shape, cutting through both layers of stock. Separate the pieces, then remove the tape and waste pieces. Glue each headdress in place, then sand a round-over along all edges of the figures, blending the headdresses into the contours of the figures.

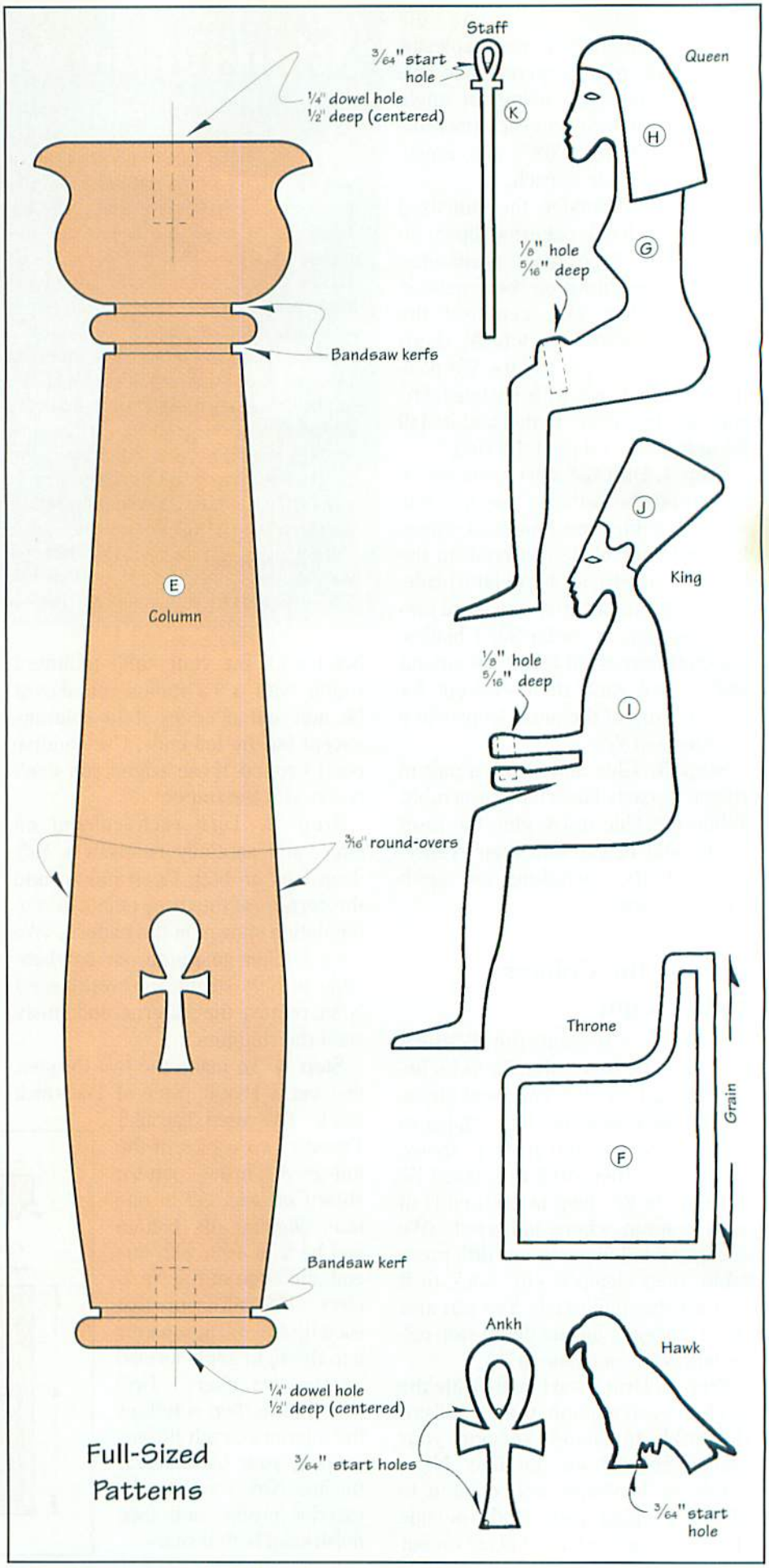
Step 3. Lay out and drill ⅛" holes 5/16" deep in the figures' hands to hold the staffs. (See the patterns for locations. To hold the figures steady at the proper angle, we clamped them in a handscrew laid flat on the drill-press table.) Now, finish-sand the figures. (We used a set of needle files and small, folded pieces of 220-grit sandpaper to negotiate the tight spaces.)

Step 4. To fashion the ankh-tipped staffs, first transfer two copies of the staff pattern to a 1x3" or larger piece of ¼"-thick padauk. Drill start holes inside the ankh loops, then scrollsaw the loops. Next, saw the staffs to shape, keeping your blade outside the line. Sand both faces of the staffs, tapering them down to ⅛" thick at the bottom end. Now, sand all surfaces smooth, rounding the corners to a circular cross section along the lower half of the staff.

Assemble and Finish Your Bookends

Step 1. Finish-sand all parts. Next, glue and clamp the thrones to the risers. After the glue has dried, epoxy the figures to the thrones. (We used a sparing amount of quick-set epoxy to avoid any squeeze-out.) Next, cut, groove, and chamfer eight 15/16" lengths of ¼" dowel. Now, glue, dowel, and clamp the lintels and columns to the base, and allow the glue to dry.

Step 2. Apply your choice of finish to all parts, including the staffs. (We brushed on two generous coats of Watco Natural Danish Oil Finish, allowed each coat to penetrate for 30



minutes, then wiped all surfaces completely dry.) Now, insert a staff in each figure's hands without using glue. This way, if a staff should ever break, you can easily remove and replace it.

Project design: Bill Zaun
Photograh: Studio Alex
Exploded view illustration: Cad Art

Kit Source

Stock Kit. Includes all the stock you'll need to build the bookends as shown: ¾"-thick walnut, ½"-thick walnut, ¾"-thick bird's eye maple, ½"-thick maple, ½"-thick cherry, 1 1/16"-thick padauk, ¼"-thick padauk, and ¼" dowel stock. Ask for Project-PAK kit No. WJ-1951. $36.95 ppd. Order from:

Heritage Building Specialties
205 N. Cascade
Fergus Falls, MN 56537
Telephone: 800/524-4184

Amana Carbide-Tipped Slotting Cutter. Includes arbor (¼" shank), three-wing cutter (¼" kerf), and bearing for ½" depth of cut. Catalog no. 50526. $24.95 plus $5.95 shipping/handling. Three-wing cutter only (catalog no. 49015), $16.95 plus $4.95 shipping/handling. Order from:

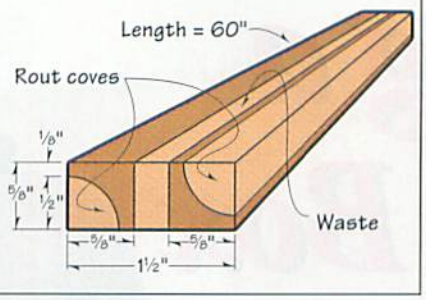
The Woodworker's Store
21801 Industrial Blvd.
Rogers, MN 55374-9514
Telephone: 800/279-4441
FAX: 612/428-8668

Jeweler's Scrollsaw Blades. Various sizes, grades, brands, and quantities are available. Call or write for detailed ordering information:

Allcraft Supply
666 Pacific Street
Brooklyn, NY 11217
Telephone: 800/645-7124

continued from page 43

Figure 3



Miter-cut the molding pieces to length and attach where shown. (We drilled pilot holes through the molding and into the table, then drove #17 x 1" brads.) Note: Don't nail the molding to the top.

Apply the Finish and Attach the Drawer Pulls

Step 1. Finish-sand all parts that still need it, working progressively from 100- to 220-grit sandpaper. Next, apply your choice of finish. (We applied a coat of Minwax Colonial Maple stain. After it had dried, we then applied one coat of Minwax Provincial stain over it to reduce the orange color of the maple stain. After that stain had dried thoroughly, we applied one coat of sanding sealer and two coats of clear polyurethane, sanding after each coat had dried with 320-grit sandpaper to level the finish.)

Step 2. Attach the drawer pulls.

Photograph: Lynxwiler Photography
Project Designer: Mark Ziobro

Sources

Edge-Clamping Kit. Contains hardware to make edge clamp for applying even pressure to both faces of an edge-joined panel. You supply standard 1 x 4s for wood bars. Catalog no. 74F01.04, $29.95 plus $6.35 shipping/handling. Order from:

Garrett Wade
161 Ave. of the Americas
New York, NY 10013
Telephone: 800/221-2492

Drawer Pulls. Heavy-duty cast-brass chest handle, 5¾" long. Catalog no. AAM10, $7.75 each plus $5.95 shipping/handling (for four). Order from:

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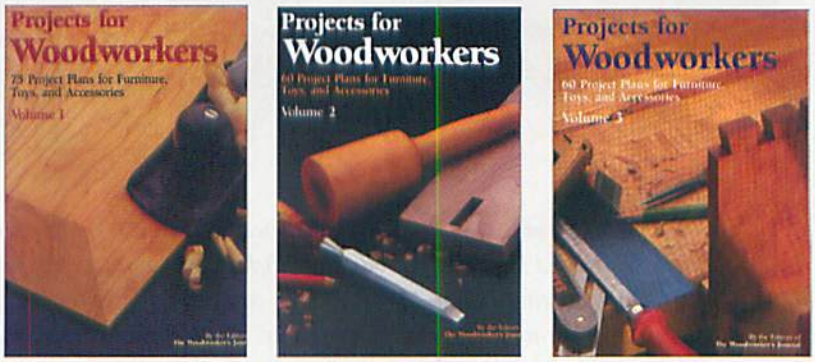
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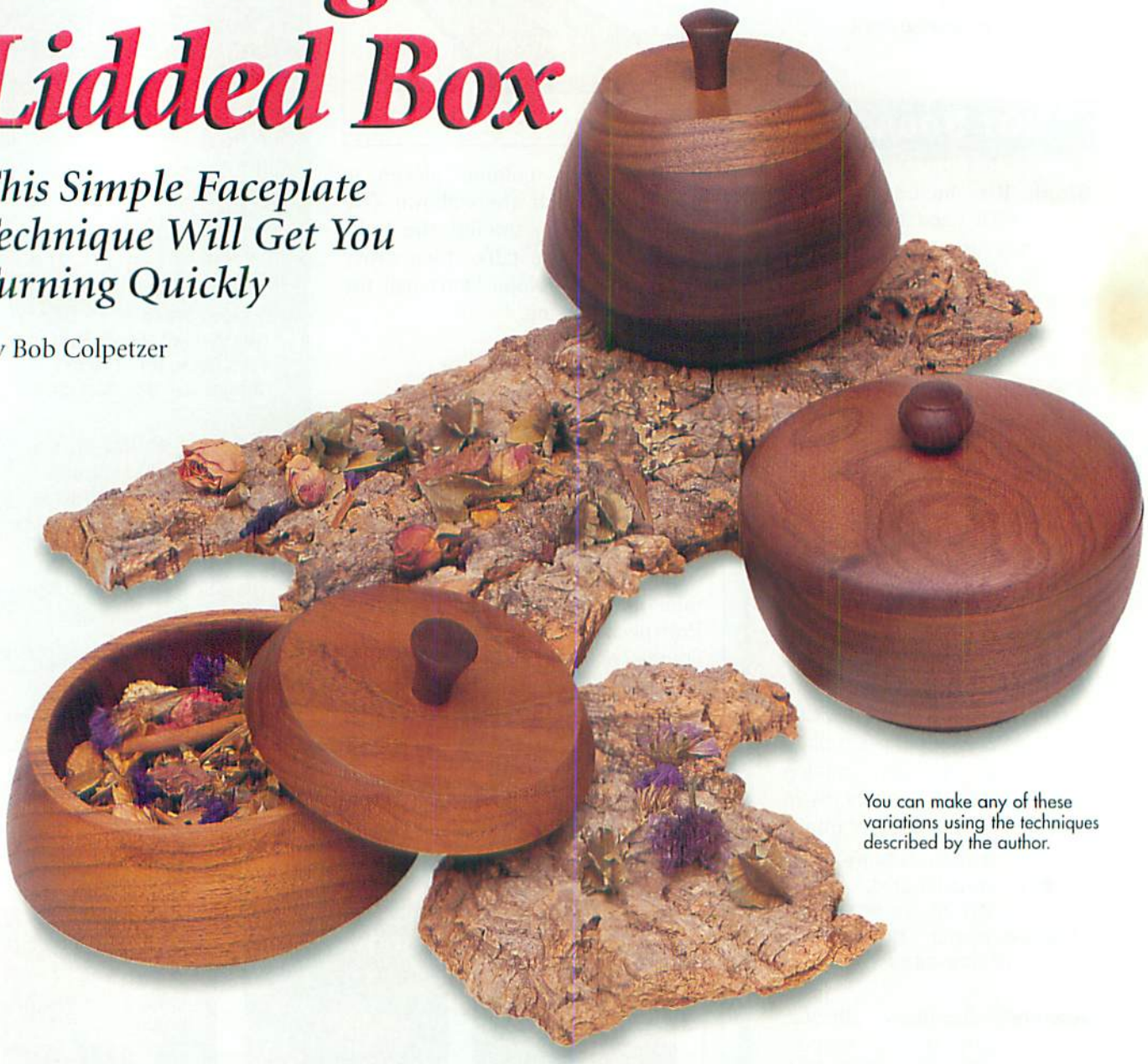
Turning a Lidded Box

This Simple Faceplate Technique Will Get You Turning Quickly

by Bob Colpetzer



You can make any of these variations using the techniques described by the author.

There's no shortage of innovative and finely engineered lathe chucks available for faceplate turning today. In fact, if you're a beginner or novice turner, you've probably noticed that there isn't much information on turning that doesn't praise or encourage the use of some type of four-jaw chuck system.

No question, these chucks do an excellent job and can grip stock in a wide variety of ways. If you're a serious turner, the convenience, versatility, and speed that these chucks offer more than make up for their cost. But if you're just getting started or if you only turn occasionally, you may have a hard time justifying a layout of $170 to $300.

If you find yourself in this latter category, don't despair. Turners produced beautiful and interesting bowls, boxes, and hollow vessels long before these chucks were invented. In this article, we'll turn one of the three attractive boxes with matching lids shown above.

To help ensure your success, I've kept the procedures, design, and tools simple. The project requires only a bit of proficiency with the scraping technique to hollow and shape the profiles. If you own a lathe and a basic set of turning tools, you've got all you need to get started. I hope you'll follow along and give it a whirl.

First, Prepare Your Turning Blanks

To match the grain and color of a box perfectly with its lid, I generally recommend starting with a 3×6×6" turning blank. But, turning blanks don't come cheap. If this is your first turning attempt, you may want to go the less costly route and laminate your own blanks from hardwood cutoffs gleaned from your scrap box.

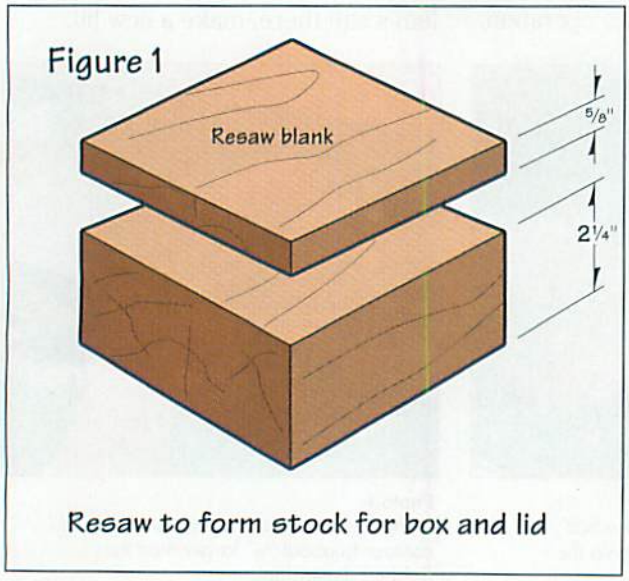
For example, three pieces of ¾"-thick stock cut from the same piece and glued face-to-face make a 2¼"-thick blank. A fourth piece can serve as the lid. This approach doesn't produce a perfectly matched box and lid, but color and grain will probably be close, and it's an affordable way to gain experience before you chuck up costly turning blanks.

To prepare a 3"-thick turning blank, mark a large *X* on the top and bottom, then resaw a ⅝"-thick slab from it for the lid *(figure 1)*. (To mail-order turning blanks, see the Sources listed at the end of the article.)

Make three backing blocks. I usually make mine from ¾"-thick scraps of pine or poplar cut to the same size as the turning blanks (6×6"). Next, adhere the turning blanks to two of the backing blocks using the paper-joint technique described in the Pro Tip on *page 56*. Set the third backing block aside—you'll use it later as a wooden chuck.

To attach these assemblies to the faceplates, first draw diagonal lines on the backing blocks to locate their centerpoints. Next, using a compass, scribe circles at least ½" larger than the finished diameter of the box. For the 5"-diameter box (profile 1) shown on *page 57*, I drew a 5⅞"-diameter (2¹⁵⁄₁₆"-radius) circle.

Center 3"-diameter faceplates on the backing blocks. Next, drill ⁹⁄₆₄" pilot holes, and drive #12×¾" flathead wood screws to secure the backing blocks to the faceplates. I drill the pilot holes large enough to ensure that the screws won't crack or weaken the backing blocks. Now, bandsaw the box and lid blanks to remove the excess material *(photo A)*, following the circles you scribed on the backing blocks earlier.



Next, Mount the Box Blank and Lay It Out

Attach the faceplate with the box blank to your lathe. Position the tool rest so that when you place the roundnose scraping tool on the rest, it will cut on center. Now (and after every setup change), turn the lathe by hand to make sure that everything clears the tool rest.

Next, you need to round down the blank by cutting away any off-centered stock. To do this, first select a lathe speed of about 500 rpm, then use a roundnose scraper to true up the blank *(photo B)*. (For more information on turning tools, see "Tools You'll Need," *page 63*.) Once you've balanced the blank, increase the lathe's speed (1,200 to 1,500 rpm). Using the same tool, reduce the blank's diameter until it measures ⅛" larger than the desired finish diameter of the box at its widest point. I measure this diameter, and others later, with a pair of outside calipers. (See the Pro Tip on *page 58*.)

We now want to reduce the diameter of the backing block to less than that of the turned box. This will allow you to turn the box's entire outside contour without interruption. Just grab a parting tool and part down into the backing block (next to the paper joint) to a depth equal to the diameter of the faceplate *(photo C)*. To reach that required depth, widen the parting cut at the perimeter to give the tool operating room. When you've reached correct

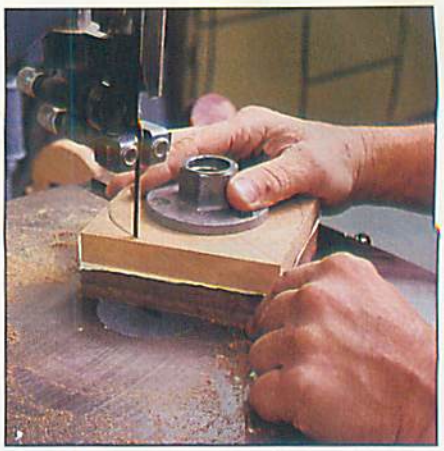


Photo A
Bandsaw both turning blanks/backing blocks round. Note: We've raised the blade guide to better show the process.

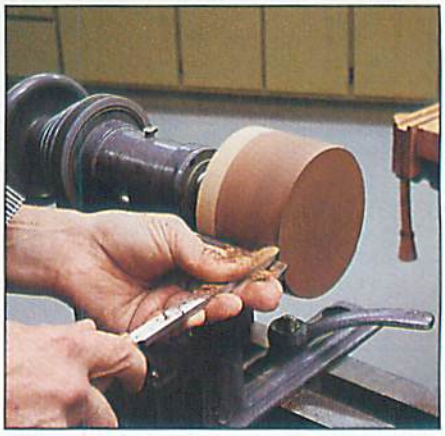


Photo B
With a roundnose scraper, round down the blank before you form the box contour.

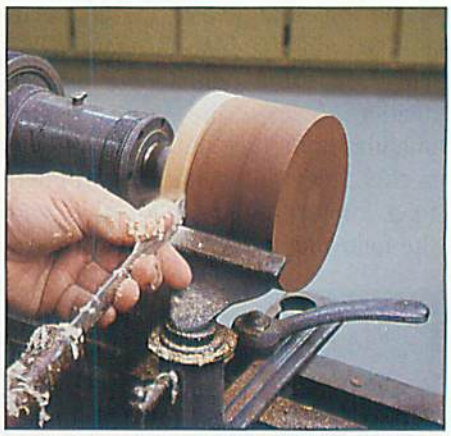
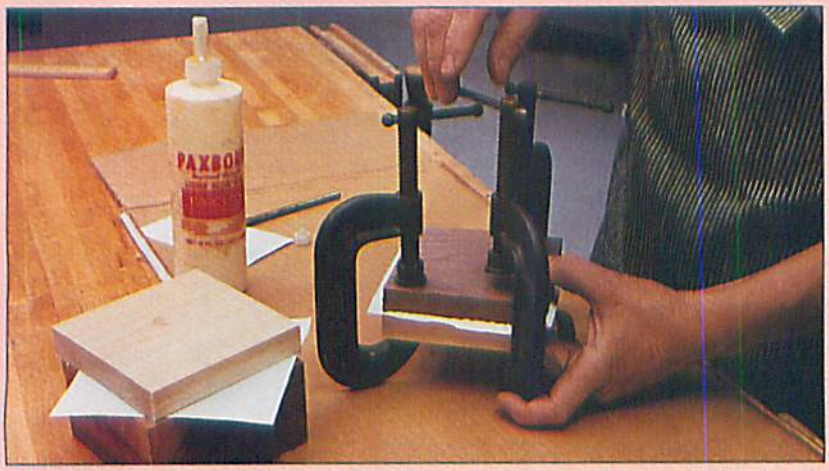


Photo C
Using a parting tool at the paper joint, cut into the backing block to start reducing its diameter.

PRO TIP

Paper joints are simple, they hold well, and they allow you to separate the parts easily from the backing blocks when finished.

First, cut pieces of paper (lined notebook paper or typing paper works fine) slightly larger than the blanks. Next, spread glue (either white or yellow) uniformly on one face of each backing block and on the X-marked faces of each blank. Place a piece of paper on the glued face of each blank, place a backing block on top of the paper, align the edges, and then clamp. Let the glue dry overnight.



To make a paper joint, glue a sheet of notebook or typing paper between the blank and backing block, and clamp until the glue dries.

depth, switch to a roundnose scraper and round down the rest of the backing block to that diameter *(photo D)*.

Transfer the critical dimensions and diameters from the Box Profile shown *opposite* (we're making profile 1) onto the blank *(photo E)*. I use a rule and pencil or a pair of dividers. Also, scribe the inside and outside diameters on the blank top at this time. Note that I've switched to a longer tool rest for this and the following steps.

Increase the lathe speed (1,800 to 2,000 rpm), then, using your roundnose scraper, start shaping the outside box contour *(photo F)*. Check the dimensions as you work, and stop when you've reduced the blank to 1/16" larger than the box's final dimension. (You'll turn the box to final dimensions with the cover attached later.)

Now, reposition the tool rest, and turn the inside of the box *(photo G)*. I use a 1/2" roundnose scraper and the same lathe speed for this operation. Work carefully, and stop the lathe frequently to check the box wall thickness and the depth. As you approach the finished depth and profile, take light cuts to smooth out the interior, using a freshly sharpened scraper resting firmly on the tool rest. Once you've finished, remove the faceplate from the lathe and set the turning aside for now.

Let's Turn the Lid Next

Mount the faceplate with the lid blank on your lathe. Next, round down the lid blank and reduce the backing block's diameter, using the same procedures you used on the box blank.

Next, lay out the inside diameter of the lid on the blank's face (exposed blank end). Then, use the parting tool to cut the groove to this diameter *(photo H)*. Work carefully and check the diameter frequently by test-fitting the box on the lid. You have a proper fit when the box presses onto the lid but does not slip as you try to twist the two parts.

If you overshoot and cut the lid a bit too small, try wetting the edge of the lid and the inside lip of the box with a damp cloth. This may raise the grain enough to hold the two parts when you press-fit them together. If this doesn't work, try folding several small strips of 100- or 150-grit sandpaper over the box edge, and then press the two parts together. Cut away the exposed parts of the strips before you start turning. If the problem's still there, make a new lid.

Photo D
Using a roundnose scraper, round down the backing block diameter to match the faceplate's diameter.

Photo E
With pencil and rule, lay out the box dimensions from the drawing onto the rounded box blank.

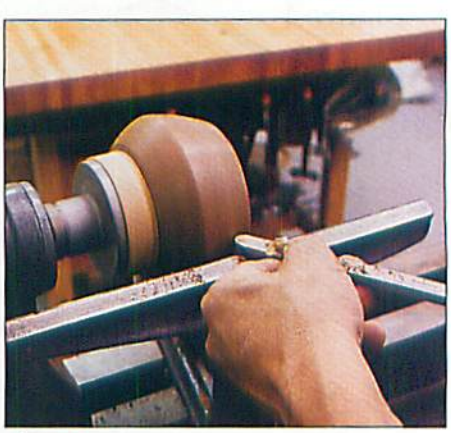


Photo F
Using a roundnose scraper, shape the box contour to about 1/16" larger than the finished dimensions.

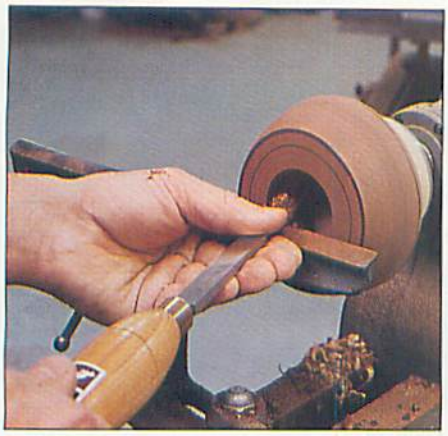


Photo G
Turn the inside of the box. Use a rule to check depth, a pair of calipers to check wall thickness.

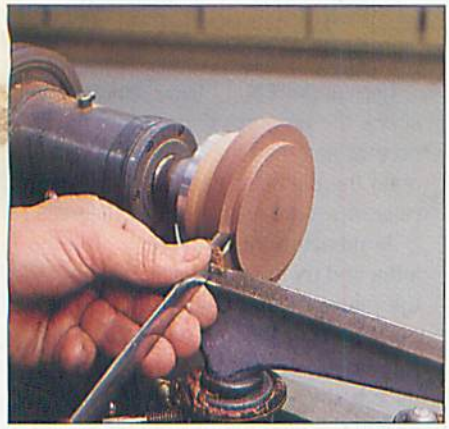
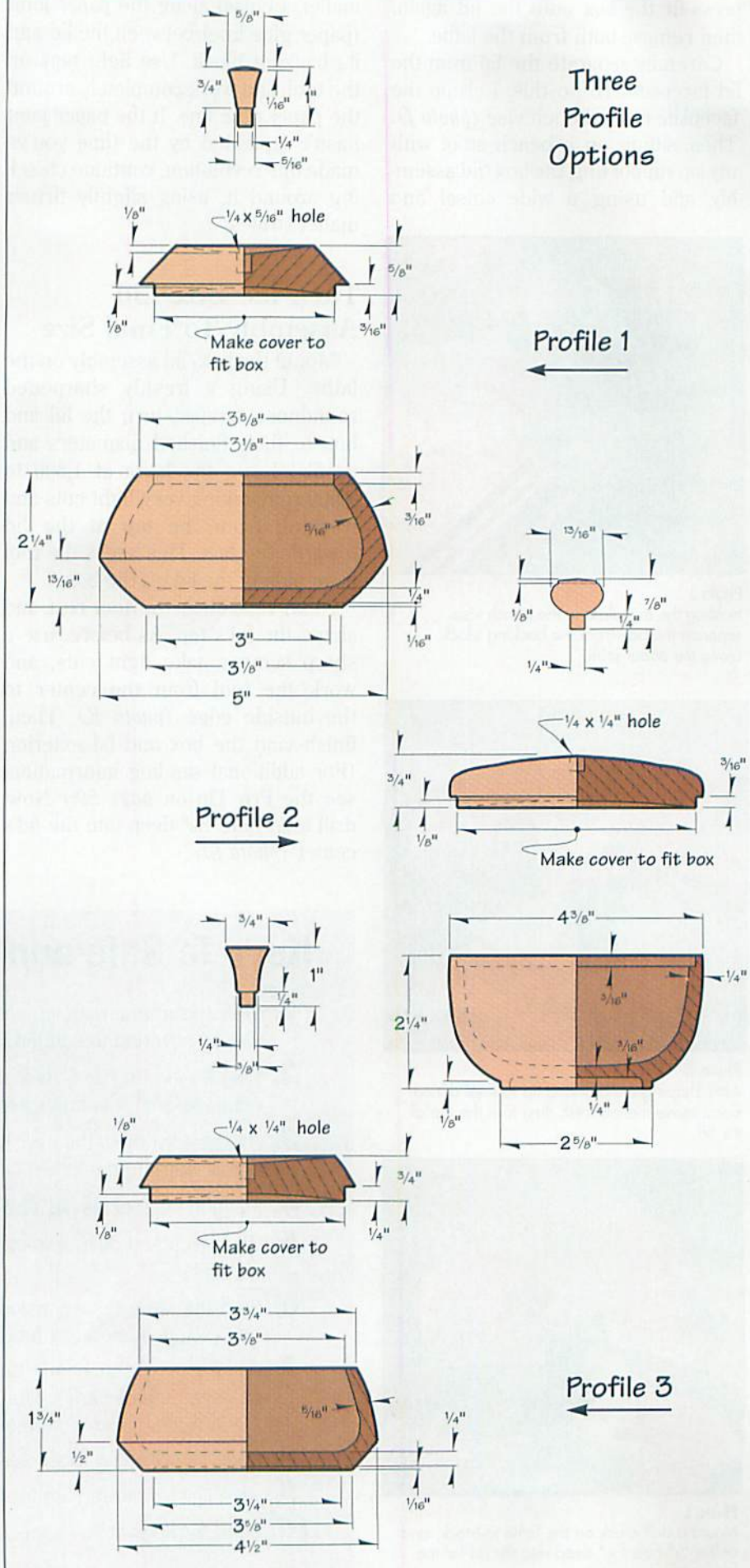


Photo H
Cut the groove on the box lid with a parting tool. Test-fit the parts frequently as you work—the box must press-fit onto the lid.

Photo I
Shape the inside of the lid. For best results, work the gouge from the center to the outside edge.

After you've achieved the desired lid and box fit, carefully pry the box off the lid. Next, using a ½" round-nose scraper, turn the inside lid contour *(photo I)*. Sand the inside face of the lid, but do not sand the lip or shoulder—this will destroy the press-fit. When you've finished sanding,

Three Profile Options



press-fit the box onto the lid again, then remove both from the lathe.

Carefully separate the lid from the lid faceplate. To do this, I clamp the faceplate in my bench vise *(photo J)*. Then, sitting on a bench stool with my lap supporting the box/lid assembly, and using a wide chisel and mallet, I chisel along the paper joint (paper glue line) between the lid and its backing block. Use light taps on the tool, and work completely around the paper glue line. If the paper joint hasn't separated by the time you've made one revolution, continue chiseling around it, using slightly firmer mallet strikes.

Photo J
Holding the faceplate in the bench vise, separate the box from the backing block along the paper joint.

Turn the Box/Lid Assembly To Final Size

Mount the box/lid assembly on the lathe. Using a freshly sharpened roundnose scraper, turn the lid and box to their finished diameters and profile. I run the lathe at 1,800 to 2,000 rpm, taking very light cuts and working from the top of the lid towards the box. This keeps the tool from pulling the lid off the box.

Next, reposition the tool rest and shape the lid's top. As before, use a sharp scraper, take light cuts, and work the tool from the center to the outside edge *(photo K)*. Then, finish-sand the box and lid exterior. (For additional sanding information, see the Pro Tip on *page 59*.) Now, drill a ¼" hole 5/16" deep into the lid's center *(photo L)*.

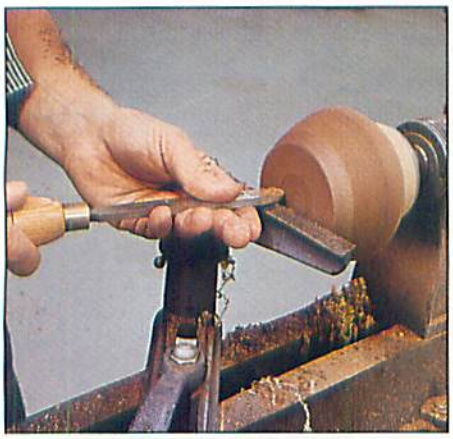


Photo K
After shaping the box and lid to final dimensions, move the tool rest, then turn the top of the lid.

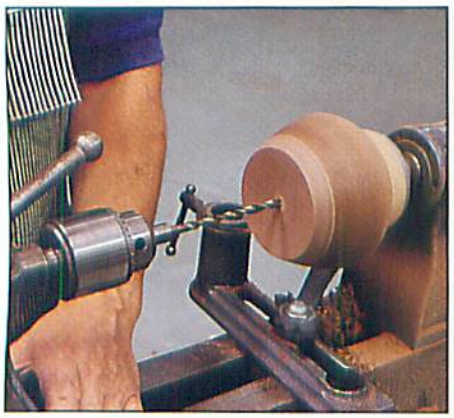


Photo L
Mount a drill chuck on the lathe tailstock, and drill a ¼" hole 5/16" deep into the lid for the knob's tenon.

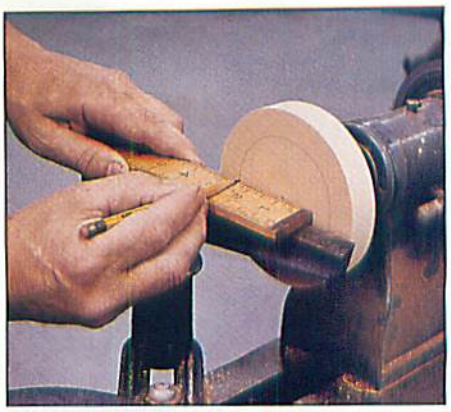


Photo M
Mount a fresh backing block, then lay out the centerpoint and the box's inside diameter on it.

PRO TIP

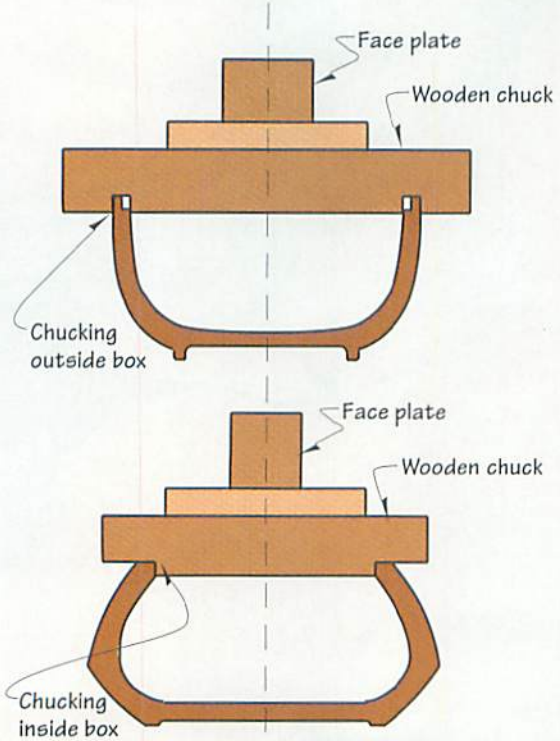
Use a pair of outside calipers to check the progress of your turning. To do this, first read the drawing to determine the diameter needed, then use a ruler to set the caliper to that diameter.

To measure the workpiece, stop the lathe and try to fit the calipers over it at the measurement point. If the calipers don't fit, turn it some more. For a correct fit, the caliper blades should gently rub the workpiece. Measure often as you get near the desired dimension. Remember, a given cut reduces the workpiece diameter by twice its depth.

Keys To Safe and Successful Turning

1. Prior to turning, remove loose-fitting clothing and all jewelry, and wear a covering to contain long hair.
2. Check the integrity of faceplates, backing blocks, and the turning blank before mounting them on the lathe.
3. Always turn the lathe over by hand to make certain all parts clear before starting the lathe.
4. Position the tool rest so it fully supports the turning tool at all times.
5. Wear face and dust protection. Everyday eyeglasses are not safety glasses.
6. Stop the lathe before making any adjustments or changes to the tool rest, headstock, or faceplate.
7. Assume a natural, comfortable stance with good footing and body balance. Remove any obstacles in your way before starting. Never reach or lean over a lathe while it's turning.
8. Keep your turning tools clean and sharp at all times.
9. Take light, uniform cuts for the smoothest finished surface.
10. Sand turnings at low speeds (500-600 rpm).

Figure 2 Shape of Box Determines Chucking



Now, carefully separate the lid from the box. Sand the box interior, then slightly enlarge the inside lip opening to allow the lid to fit freely. When finished, remove the box from the backing block using the same technique described earlier to separate the lid from its backing block.

Now You're Ready To Turn the Box Bottom

Mount your third backing block on a 3" faceplate, and round it down. Next, locate the centerpoint, and lay out the inside diameter of the box on the block's face *(photo M)*.

Move the tool rest to the side, and using the parting tool, cut to the inside diameter line *(photo N)*. In this step, you are creating a lip onto which you'll press-fit the box. It must fit tightly over this lip and not turn, so test-fit the parts frequently as you work. If you're turning box profile 2, you need to prepare the wooden chuck as shown in the top example in *figure 2*.

To turn the bottom, first position the tool rest so the roundnose scraper will cut on center. Then, set your lathe speed at 1,200 to 1,500 rpm, and work slowly from the box center to the edge, taking light cuts *(photo O)*. When you're satisfied with the bottom contour, slow the lathe, sand the bottom, then remove the box from the backing block.

PRO TIP

Contrary to what some people believe, sanding at a lower speed (500 to 600 rpm) gets the job done faster and with less sandpaper. High-speed sanding generates heat, dulls the abrasive particles faster, and glazes both the abrasive and wood fibers. If you generate enough heat to burn your fingers while holding the abrasive, you're running the lathe too fast. Keeping the paper moving helps too.

Depending on the kind of wood and the smoothness of the turned surface, I usually sand with a progression of garnet papers–80-, 120-, 180-, and 220-grit. Always wear a dust mask or respirator to minimize dust inhalation.

Turn the Knob and Apply the Finish

To turn the knob, you need to make a jam chuck, but we'll use the faceplate and wooden chuck still mounted on the lathe from the last step for this. Bore a 1⅛" hole ⅝" deep in the center. I use a multispur bit for this, but if you don't have one of the right size, use a bit close to that size, then turn the hole to final dimension.

Next, cut a ⅞x⅞x2" blank from the desired stock, and tap it into the

continued on page 63

Photo N
Using your parting tool, cut a lip into the backing block to accept the box.

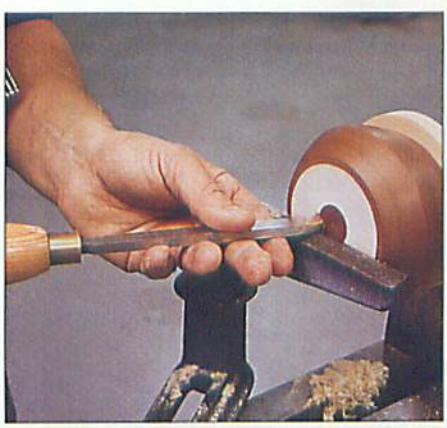


Photo O
Mount the box on the lip, then shape the box bottom, cutting from the center toward the outside edge.

Photo P
To form the knob, bore a 1⅛" hole into the backing block, insert the blank, then turn the knob to shape.

Photo A: Piloted bit cuts a biscuit-shaped slot into the board's edge when the bearing rolls into a scallop.

Photo B *(below)*: Combining the jig and workpiece support enables you to cut matching biscuit-shaped slots into the face of a workpiece.

VERSATILE BISCUIT SLOTTING SYSTEM

We Make Biscuit-Joining Easy

Biscuit joints are easy and fast to make, and their holding power will amaze you. So, it's not surprising that more and more woodworkers continue to find new ways to use this versatile joining technique in their woodworking. In fact, the jig described here evolved from a design originally contributed by reader Rick Brucken. If you don't already own a biscuit joiner, consider trying this system. It requires only minimal construction time and an inexpensive slotting cutter, arbor, and bearing kit.

Our System and How It Works

This approach employs a scallop-edged jig, a matching workpiece support, and a slotting cutter. We made the jig and support from Baltic birch plywood, although ordinary plywood or even particleboard will suffice. The slotting cutter parts can be mail-ordered. (See the Source list at the end of the article).

Used alone, the jig allows you to slot the edge of a workpiece for biscuits *(photo A)*. Simply assemble and chuck the slotting cutter into your router,

place the jig on the edge of the workpiece, clamp it, then follow the jig's edge with the router. When the bearing on the bit rolls into a scallop, the cutter makes a slot in the board's edge.

Combining the jig and workpiece support enables you to cut matching slots in the face of a board *(photo B)*. By slotting the edge of one piece and the face of another, you can biscuit-join pieces at right angles to each other.

To set up, first clamp the workpiece support to your bench. Next, select the desired biscuit-spacing interval, position the jig on the support with the appropriate edge exposed, and bolt it to the top. Then, position the workpiece under the jig, clamp, and rout.

Photo C: Slotting cutter parts needed to cut slots for commercially available #0, #10, and #20 biscuits with this jig.

The holes in the face of the workpiece support allow you to insert C-clamps or adjustable bar clamps through them to clamp almost any size of workpiece for slotting. The adjustable horizontal clamp bar provides the points for clamping the support to a table or bench. By raising or lowering its position on the support, you can adjust its height as necessary.

We made the jig and support 42" long. If you need to slot longer stock, position the jig at one end of it, and rout the length of the jig. Then, reposition the jig, and slot the rest of the workpiece.

To slot a piece shorter than the jig, first determine the optimum number of slots that will fit along its length, calculate the leftover length, divide that number in half, and set the centerline of the first scallop that distance from the end of the workpiece.

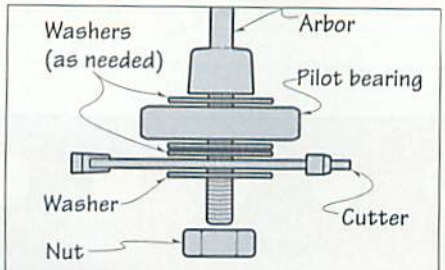


Figure 1

The 5/32"-thick slotting cutter, used in combination with one of the bearings in the adjustment kit *(photo C)*, will cut perfectly sized slots for either #0, #10, or #20 biscuits. (The fourth bearing produces a 1/4"-deep slot not intended for use with biscuits.) When ordering, you can select either a 1/4" or 1/2" arbor and bearing assembly.

For most operations, you'll assemble the cutter as shown in *figure 1*. First, position the bearing on the arbor so it rolls along the edge of the jig. Then, place enough washers between the bearing and cutter to center the cutter on the edge of your workpiece.

Let's Construct the Jig First

Step 1. Cut a piece of 1/2" plywood 10" wide and 42" long. Set your marking gauge at 3 3/8", and scribe a line along one edge of the top face and on the opposite edge of the bottom face of the piece.

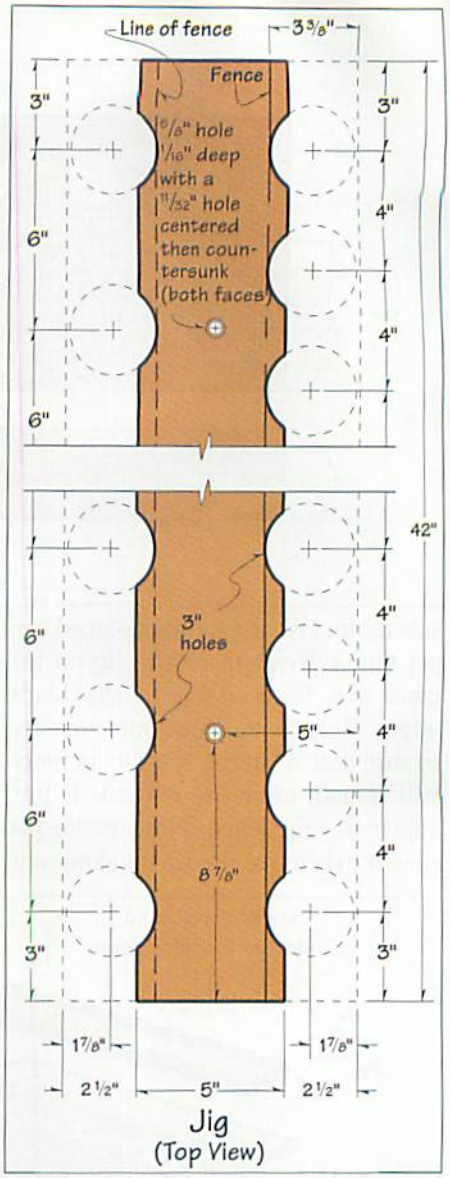
Step 2. Scribe a line 1 7/8" in from the same edges on both faces. You'll lay out the centerpoints for the 3" holes on this line.

Step 3. Using the dimensions shown on the Jig Top View drawing *above right*, lay out the 3" hole centerpoints.

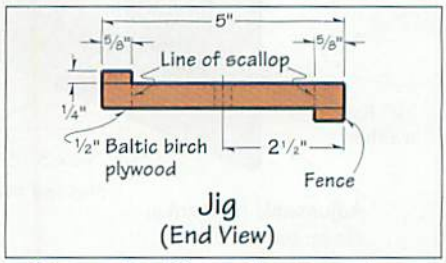
Step 4. Using a square, extend these hole centerlines beyond the circumference of the holes—you'll use them to mark dead center in each scallop later. Next, lay out centerpoints for the two 5/8" holes.

Step 5. Bore or cut out the 3" holes. (We used a wing cutter chucked into our drill press and placed a backing board underneath to prevent chip-out.)

Step 6. From 1/4"-thick hardwood stock, rip and crosscut three 1x42" strips for the jig fences. (We used maple planed to this thickness.)



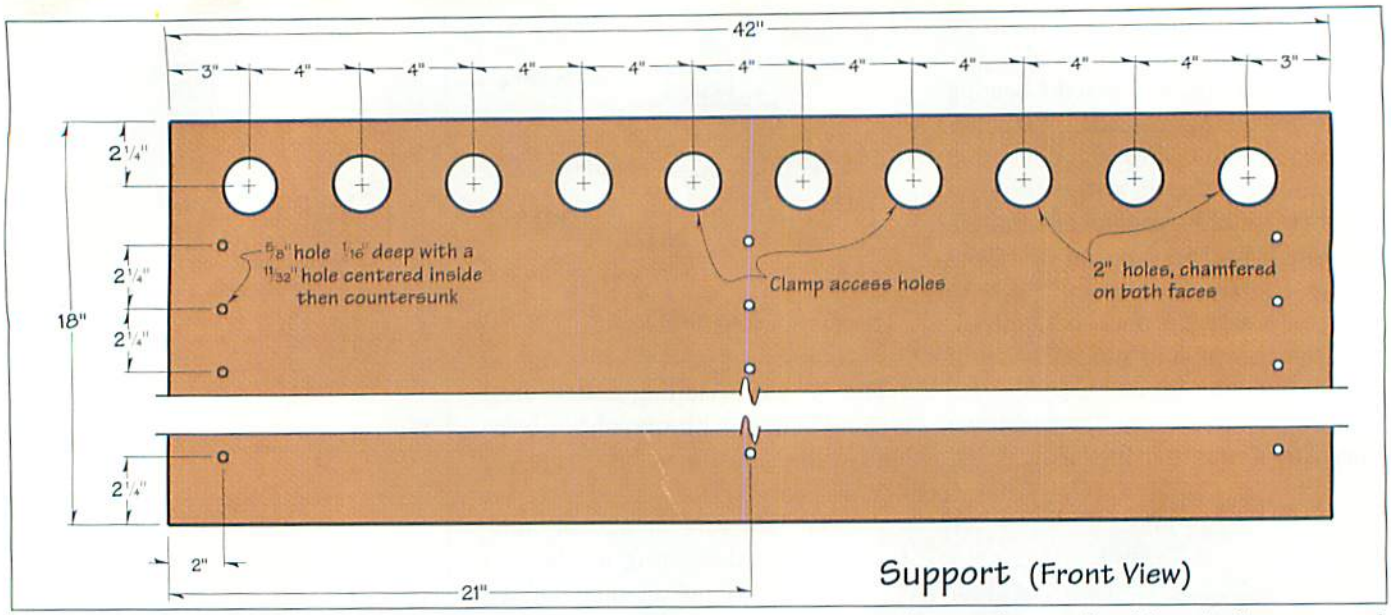
Jig
(Top View)



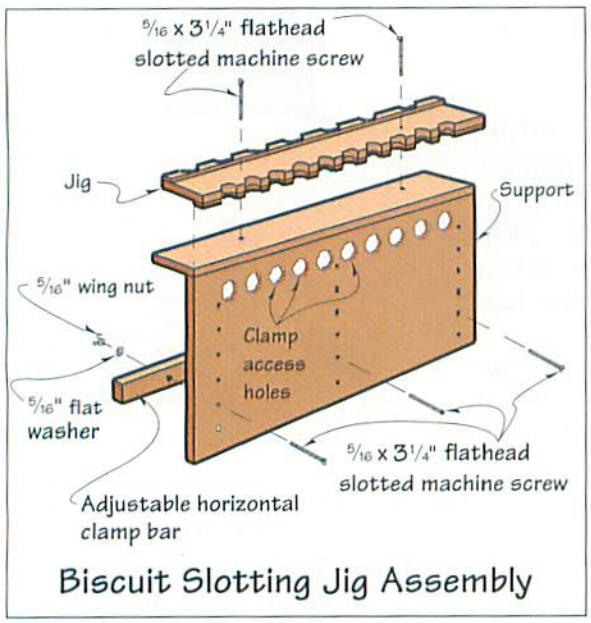
Jig
(End View)

Step 7. Glue the two fences (1/4" strips) to the jig. (We first clamped a straightedge against the inside line 3 3/8" in from each edge and squared it to the piece. Next, we glued and clamped one of the 1/4x1x42" strips to the face of the jig and against the straightedge.) Prepare the opposite side the same way. Note: The fence strips will partially cover the holes.

Step 8. Set your tablesaw rip fence 7 1/2" from the blade. Temporarily adhere the third 1/4"-thick strip you cut in Step 6 to the underside of the jig as a spacer, so it will lie flat on the



saw table. (We used double-faced carpet tape.) Next, place the jig on the table and bring it up to the blade edge. Before cutting, measure to ensure that ⅝" of the 1"-wide jig fence will remain after the rip cut. If not, adjust the rip fence. Now, make the rip cut to remove the waste along one edge. Note: After you've made all cuts, the jig should appear as dimensioned on the Jig End View drawing.



Biscuit Slotting Jig Assembly

Step 9. Reattach the temporary ¼"-thick spacer strip to the jig's opposite face. Reset the saw's rip fence 5" from the blade, check to ensure that you'll leave ⅝" of the guide fence remaining on the uncut edge, then make the rip cut.

Step 10. Using your bandsaw, cut away the excess of the ¼" strip left in each scallop. (We sawed close to the arc to remove most of the waste.) Then, set up your table-mounted router with a flush-trim bit, and rout away the fence excess to match the scallop arcs. (To avoid routing against the grain and possibly chipping out the edges, we routed from the edges toward the center of each scallop.)

Step 11. Drill the two holes through the jig where shown and dimensioned on the Jig Top View drawing. Note: Counterbore and countersink the holes on both faces.

Step 12. Using a square and the centerlines you extended in Step 4, scribe the dead center in each scallop. Finish-sand the jig, then apply a clear finish.

Next, Make the Workpiece Support

Step 1. Cut a piece of ¾"-thick plywood as dimensioned on the Support Front View drawing *above*. Next, lay out the hole centerpoints and bore the holes. Note: We spaced the clamp access holes at 4" intervals. If your clamps can't span this distance, bore these holes closer together.

Step 2. To make the support top, cut a piece of ¾"-thick plywood to 3½x42". Glue and clamp the top to the top edge of the workpiece support. (We used right-angle supports to hold the two pieces square while the glue dried.) From scrap stock, rip and crosscut five 1x1½x3" glue blocks. Glue and clamp these blocks to the underside of the top and against the support.

Step 3. Place the jig on the support top with the jig's fence against the edge and the ends aligned flush. Using the existing holes in the jig as guides, drill the two 11/32" holes through the top.

Step 4. For the clamp bar, rip and crosscut a piece of hardwood stock to 1½x2¼x48". (We used maple.) Using the existing holes in the support as guides, drill three 11/32" holes through the clamp bar.

Step 5. Finish-sand the work support and clamp bar, then apply a clear finish. Finally, assemble the work support and jig as shown on the Biscuit Slotting Jig Assembly drawing at *left*.

Hardware required: three 5/16x3¼" flathead slotted machine screws, two 5/16x2" flathead slotted machine screws, five 5/16" wing nuts, five 5/16" flat washers.

Design: *Rick Brucken, Mark Ziobro*

Photographs: *Kevin May*

Kit Source

Biscuit-Slotting Parts. Router arbor assembly with bearing, catalog no. 197-0502A (¼" shank) or no. 197-0505A (½" shank), $5.99. Slotting cutter, 3-wing, 5/32" cutting width, catalog no. 146-0830, $11.99. Biscuit slot-cutting adjustment kit, includes three bearings, catalog no. 196-0012, $20.99.

Eagle America
P.O. Box 1099
Chardon, OH 44024
Telephone: 800/872-2511

READERS' INFORMATION EXCHANGE

Help! After a year-long search, I have not found an instructional manual for a Sears Router Crafter, model 720-25250. I will pay for the copying and postage—hope someone can help.

John Haase
32 Eagle Drive
Whiting, NJ 08759-3704

I need to find the upper part (where the blade fits) of a Sears 20" scrollsaw model 103.23150. I would also like to get a copy of the owner's manual, parts lists, and/or a parts source.

Marilyn Young
232 East Shrode Street
Monrovia, CA 91016-5062
818/358-0664

I need an owner's manual and parts list for a Craftsman tablesaw model 113-22401.

Raymond Deets
1907 Grant Street
Evanston, IL 60201

Several years ago, I purchased several cedar chest kits. I need more of them but am unable to find the company that sold them. I think the name of the company was Bedford, but I've lost the address. Can any one give me the names and addresses of companies that currently sell these kits?

M. C. Isaminger
17517 C 52nd Avenue W.
Lynnwood, WA 98037

Does anyone know of a firm that sells wheelcutters (the type that you chuck into a drill press) for making wooden toy wheels? I have written to several firms but apparently the addresses were old because the letters were returned to me.

George B. Price
R.R. 1, Box 133A
Redfield, AR 72132

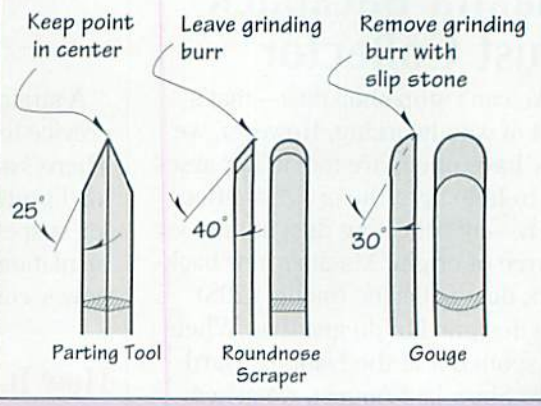
Continued on page 65

Tools You'll Need

To turn these lidded boxes, you'll need two 3"-diameter faceplates, a ½" roundnose scraper, a ⅛" parting tool, a ⅜" spindle gouge, and an outside caliper. An inside-reading caliper for measuring the workpiece wall thickness would be helpful but is not essential.

Turning tools work most efficiently when cutting edges are sharp and properly angled. Sharpen your tools to the angles shown in *figure 3.*

Figure 3 Tool Grinding Angles



SOURCES

Bowl Blanks. 3x6x6" available in Honduras mahogany, walnut, maple, and cherry. Prices range from $7.20 to $14.25. Order from:

Albert Constantine & Son, Inc.
2050 Eastchester Road
Bronx, NY 10461
Telephone: 800/223-8087

Bowl Blanks. Most hardwoods available in a variety of sizes. Prices vary from $7 to $10, depending on size and species. For ordering information, call:

Lumber Pak
Hardwood Store
1695 Dalton Drive
New Carlise, OH 54344
Telephone: 800/849-9174

Bowl Blanks and Turning Supplies. Supply and prices vary. Call for information and availability:

Packard Woodworks
P.O. Box 718
Tryon, NC 28782
Telephone: 704/859-6762

hole you just drilled in the backing block. Round down the blank, then, using a spindle gouge and a parting tool, turn the knob to shape *(photo P)* as dimensioned on the drawing. Finally, finish-sand the knob, cut it from the blank, and glue it into the lid's hole.

Apply your choice of finish. I usually apply three coats of Watco Danish Oil or Rockler's Nordic Oil finish to my boxes, letting each coat dry overnight and leveling it with a synthetic wool pad before applying the next. After the final coat has cured for five days, I'll apply wax and then buff it with a soft cotton cloth. WW

Project design: *Bob Colpetzer*
Lead photograph: *Studio Alex*
Other photographs: *By the author*

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SHOP TEST

We Test the Makita Backpack Dust Collector

We can't stop shop dust—that's part of woodworking. However, we now have one more tool in our arsenal to help fight the problem effectively—by collecting dust at the source of origin. Makita's new backpack dust collector (model 420S) was designed to do just that. When we spotted it at the National Hardware Show last August, we asked immediately for a unit to test in our woodshop.

How the Collector Works

Makita designed the collector to be portable as well as compatible with a variety of small dust-generating power tools. Its backpack configuration and shoulder harness enable us to do just what the name suggests—carry it on our back.

The 5'-long flexible hose comes with a different-sized cuff at each end. The larger cuff fits 1¼"-o.d. connectors, such as those found on some belt sanders. The smaller cuff fits the ⅞"-o.d. connectors found on many finishing and orbital sanders.

Makita has incorporated the new power-tool trigger control feature. You plug your power tool into the electrical outlet on the backpack, and this allows you to turn on tool and collector simultaneously. Switch off the tool, and the collector continues running for a few additional seconds to clear the hose.

The backpack stores the collected dust in its base. To empty, simply open the compartment cover. An easy-to-reach lever provides immediate filter clearing between clean-outs. The internal filter can be removed and cleaned with water when necessary.

A straight pipe, two brushes, and a crevice tool come with the unit. There's also a reset button for overload protection, an integrated hook for suspending the collector, double insulation for safety, and a 17'-long power cord.

How It Worked For Us

Our dust-free eyeglasses—after an hour of orbitally sanding some cherry and maple panels—attest to the collector's ability to do its job.

We found the backpack capability to be marginally useful, especially if you work with mostly smaller pieces. However, it certainly would come in handy for sanding millwork or flooring in a house, for example, where you need to range over a large area.

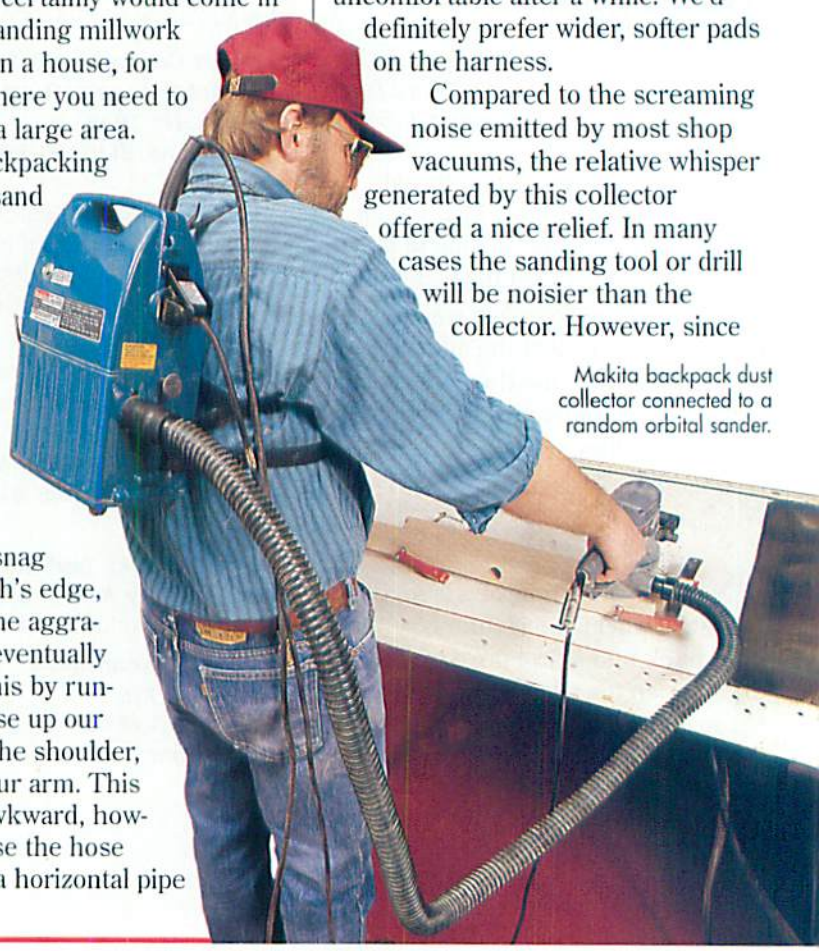
When backpacking the unit to sand a table or bench surface, we found that the hose tended to hang over the bench's edge. Often the hose ribs would snag on the bench's edge, causing some aggravation. We eventually remedied this by running the hose up our back, over the shoulder, and down our arm. This gets a bit awkward, however, because the hose attaches to a horizontal pipe and must be bent to route it over the shoulder. We concluded that a simple L-shaped coupling fitted between the collector's intake pipe and the hose would eliminate this bend.

Hanging the collector above the work area by its built-in hook worked well for benchtop sanding and eliminated the bench-edge hose snagging.

The extra-long power cord proved handy when we needed to move around a lot, but trying to keep it under control in less mobile situations became tiresome. We'd like to see a hook or a strap on the collector to hold the cord coiled when its full length isn't needed.

Carrying the 6½ lb. unit on the back wasn't difficult or unusually fatiguing. However, the narrow shoulder straps and pads became uncomfortable after a while. We'd definitely prefer wider, softer pads on the harness.

Compared to the screaming noise emitted by most shop vacuums, the relative whisper generated by this collector offered a nice relief. In many cases the sanding tool or drill will be noisier than the collector. However, since



Makita backpack dust collector connected to a random orbital sander.

both tools operate at the same time, we recommend that you wear ear protection.

The collector employs a three-wire grounded plug that must be connected to a properly grounded outlet. It's also double-insulated to protect the operator against electrical shock.

The Bottom Line

We feel that the unit generated adequate suction for the job it was intended for—collecting dust. (Its suction compares with that produced by many upright household vacuum cleaners.) However, we found that very fine dust, such as orbital sanding produces, tended to rapidly block the filter. This required frequent cleaning to maintain good suction. At the other extreme, don't expect the collector to handle large volumes of sawdust or heavy chips.

Listed at $480 suggested retail, the collector appears, at a glance, to be overpriced. (Makita has just started shipping the first units, and a street price hasn't yet been established.) However, if you work in a small shop where space is at a premium and fine-dust control is essential, or if your work requires mobility and portability, then we think it's a tool you'll definitely want to consider. WWJ

Product Details

Makita Dust Collector	Model 420S
Max. Peak Air Flow	42.4 cu. ft./min.
Max. Sealed Suction	47" of water
Weight	6.4 lbs.
Overall Size	9x5¼x13¼"
List Price	$480.00

READERS' INFORMATION EXCHANGE

Continued from page 63

I need an owner's manual and parts list for a Walker-Turner bandsaw (The Driver) manufactured in Plainfield, New Jersey. The saw has 10" wheels.

John Lauviere
10 Squire Lane
Bellingham, MA 02019

I inherited my father's bandsaw, a 100' roll of bandsaw blade, the jig, silver solder, and flux. Unfortunately, the know-how to solder the blades went with Dad. Can anyone provide me with information on how to make up bandsaw blades this way?

Edward J. Roncin
1009 Barton Avenue
Pt. Pleasant, NJ 08742-3612

I need a copy of the owner's manual for a Sears scrollsaw, model 113.20500, circa 1971.

William M. Tomko
4518 Foxtail Drive
Nazareth, PA 18064

WWJ

Courting Flute *continued from page 47*

need to position these parts to allow some air to escape out the front air hole. The size of this opening affects both the tone and volume; you'll probably have to experiment to find the most pleasing sound. (See "Playing Your Courting Flute" in the box at *right*.) WWJ

Photographs: *David Peters*
Illustrations: *Cad Art*
Project design: *David Moretti*
Flutist: *Gabrielle Peters*

Kit Source

Flute Accessory Kit. Includes a 3-ft. length of leather thong, four beads, and a thin strip of plastic for the volume-control slide. $3.50 ppd., $4.50 in Canada. Order from:

Aspen Kits
6 Hilltop Drive
Old Saybrook, CT 06475
Telephone: 203/388-6179

Playing Your Courting Flute

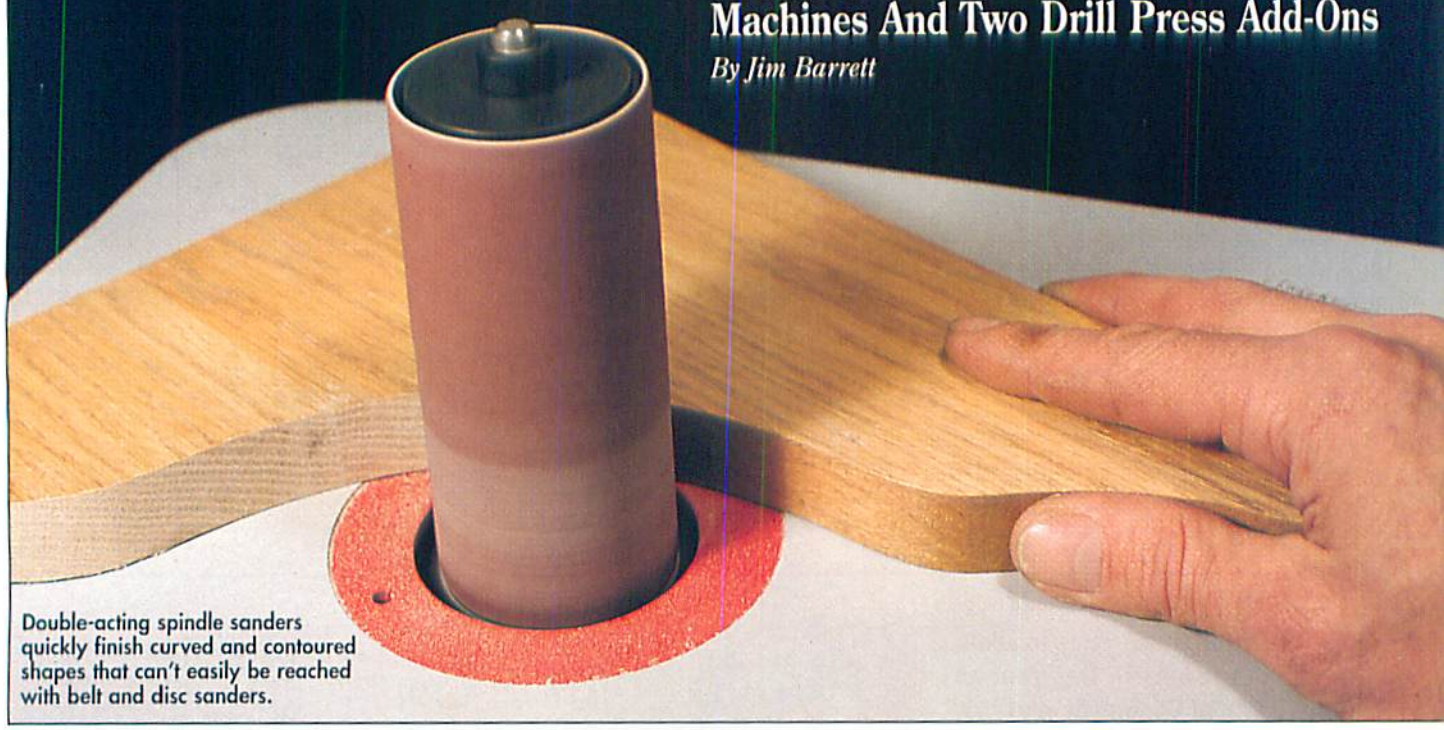
There's no one "correct" way to play the flute. You'll want to finger the six holes using the index, middle, and ring fingers of both hands. Your flute should produce a soft, mellow tone—not the shrill whistle that some metal instruments make.

As with any wind instrument, you need to provide a steady, well-modulated stream of air to produce a pleasing sound. If you're making an uneven sound, try blowing more softly. If you're having trouble making any sound, check to see that the opening in the volume-control slide is positioned over both air holes. The saddle should be located with the slot partially over the front hole. Control both the volume and tone of your flute by moving the slide and saddle forward or back. Try different positions until the tone sounds best. Even a slight adjustment can make a big difference, so move the saddle and/or slide only a little bit at a time.

Five Choices Under $350
OSCILLATING SPINDLE SANDERS

We Test Three Affordable Benchtop Machines And Two Drill Press Add-Ons

By Jim Barrett



Double-acting spindle sanders quickly finish curved and contoured shapes that can't easily be reached with belt and disc sanders.

Round an' around, an' a up and down...That line from Chuck Berry's classic rock 'n roll tune kept going through my head as I worked with these machines. That's essentially how oscillating spindle sanders work. As the sanding drum spins, it also oscillates up and down, providing unbeatable action for sanding curved saw cuts.

Old-Fashioned Drum Sanding? It's History

We've all chucked sanding drums into our drill press and tried to finish-sand curved edges. That approach works for some purposes, but an oscillating sander beats it hands down. One thing that's always bugged me about drill-mounted sanding sleeves is their tendency to clog and wear out so quickly. And once they're filled with sawdust, they often burn or glaze the wood you're trying to sand. Or, sometimes they'll leave horizontal scratches in the wood, which require additional hand-sanding to clean up.

The up-and-down action of an oscillating sander eliminates most of these problems. With more of the sleeve's surface area utilized, the sleeve tends to clog less and wear longer. The oscillating motion sands with and against the grain simultaneously, cutting wood fibers cleanly and quickly. This cleaner yet more aggressive sanding action also requires less effort on your part to push the workpiece against the sanding drum, which in turn reduces spindle flexing and deformation. You thus end up with a flat, square edge on the workpiece.

If you do a lot of heavy-duty drum sanding on your drill press, excessive sideways pressure against the drum may cause the bearings and other drive train parts to wear out prematurely. Drill presses generally have not been designed to withstand excessive sideways pressure against the quill.

Good News For Us Budget-Conscious Woodworkers

Okay, so maybe I've nudged your interest in adding an oscillating spindle

sander to your shop. But you probably remember these sanders as being large, heavy, budget-busting stationary machines—way too much tool for most of our home shops.

Well, the good news is that several manufacturers now offer affordable benchtop models. I tested three such units currently priced at under $350—the Powermatic Artisan 14 (at *right*), the Ryobi model OSS450 *(photo 2)*, and the Sears model 22590 *(photo 3)*. Compact and relatively lightweight, they take up surprisingly little space and can be stored under a bench when not in use. I also tested two nifty accessory units that transform a drill press into an oscillating spindle sander. Attached to an existing machine, they require virtually no shop space at all. You can read more about both units on *pages 70 and 71.*

Other dedicated benchtop models not tested include two Clayton models and the Vega model 053. The Clayton sanders are heavy-duty, precision machines designed for continuous use, definitely a step up from the sanders reviewed in this article. As you might guess, both carry a higher price tag—$625 for the model 140 (which accepts drums up to 4" long) and $685 for the model 146 (for drums up to 8½" long, including pneumatic types). Both machines exceed the $350 price-tag limit we set for this review, but I've included Clayton in the Sources list on *page 72,* in case you'd like more information on them.

The Vega sander fell within our $350 ballpark but was not available for review. A Vega representative indicated that they intend to revise the design of their unit. You'll find them in the Sources list as well.

If you're looking for floor models, check out the Clayton 106 ($845), the Crouch 290-4.5 ($895), and the Enlon EN3407 ($565.) Again, see the Sources list for the manufacturers' addresses and phone numbers.

A Quick Look Inside

The sanders we tested incorporate an interchangeable sanding drum that projects vertically through a worktable. The table is mounted on a base that houses the motor and oscillating mechanism. Each machine uses a different mechanism to produce the up-and-down motion. (See the cutaway illustrations on *page 68.*)

Open the Powermatic and you'll find a steel worm gear on the motor shaft driving a pinion reduction gear, which in turn attaches to a yoke assembly that moves the spindle up and down.

On the Ryobi, you'll find two slightly different sized pulleys at the spindle base. The upper drive pulley, attached to the spindle, revolves faster than the lower freewheeling pulley. Matching cams attached to these pulleys produce the up-down shaft movement as they turn.

The Sears unit employs a direct-drive system in which the motor shaft also serves as the spindle. An eccentric attached to the bottom of the spindle engages a gear and cam follower. As the eccentric rotates, the gear engages the ring gear that's molded into the housing, turning the cam follower at one revolution per second. The cam follower rides a dual ramp molded into the bottom of the housing, producing the up-and-down action.

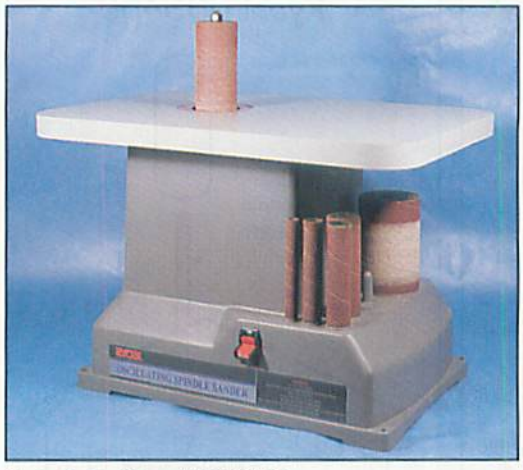


Photo 2: Ryobi model OSS450

Photo 3: Sears model 22590

How the Sanders Performed

While it's interesting to see how the drive mechanisms work, the bottom line is how well they work. Here's what I discovered.

Power. Motors need to drive the spindle without bogging down under load. For the present purpose, we'll define a "heavy load condition" as sanding the thickest stock the machine will take, using the largest drum available for the tool. The three machines I tested accept drums up to 3" in diameter and have a maximum sanding height ranging from 3⅜" to 3¾". (See the comparison chart on *page 69* for all specifications.) For this test, I mounted a 3" drum on each machine and sanded 3"-thick stock.

Even though I applied much more pressure than you'd ordinarily use during normal sanding, I had a tough time stalling any of the motors. Surprisingly, the 3.5-amp universal motor on the Ryobi seemed to deliver more power than the 9-amp induction motor on the Powermatic—the former was virtually unstoppable. But the Powermatic, as well as the Sears with its 3.2-amp induction motor, still had more than enough power for routine sanding.

Even though the Ryobi topped the others in power, I wouldn't recommend it for heavy, continuous use. Universal motors are designed for short-term, intermittent operation and generally don't last as long as continuous-duty induction motors. For that matter, however, I wouldn't use the other two machines for anything heavier than occasional home shop use. In spite of their

having induction motors, they weren't designed to stand up to day-in, day-out production work either.

Noise and Vibration. Machine noise and vibration usually go hand-in-hand, and these two factors will often (but not always) clue you in to overall construction quality. The Powermatic, with its heavy cast-iron and steel parts and smoothly operating gear drive, was the quietest machine. It also produced the least amount of vibration, thanks to its sheer mass as well as a smooth drive train.

The Sears vibrated the most, emitting a deep, intermittent rumbling noise and vibration as the spindle reached the bottom end of its travel. I was able to quiet the machine considerably by bolting it to a piece of ¾" plywood, then clamping the plywood to my bench (a good idea with all of these tools).

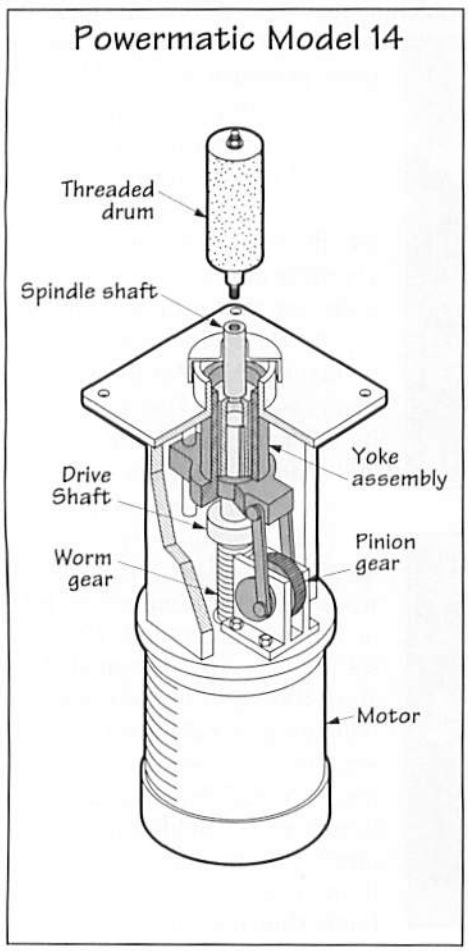
Although the Ryobi didn't vibrate nearly as much as the Sears, it was much noisier due to the high-pitched whine of its universal motor. It was the only machine in the group that tempted me to put on my ear protection. (You will, however, need hearing protection with any of the machines if you attach a vacuum. See my comments on dust collection on *page 70.*)

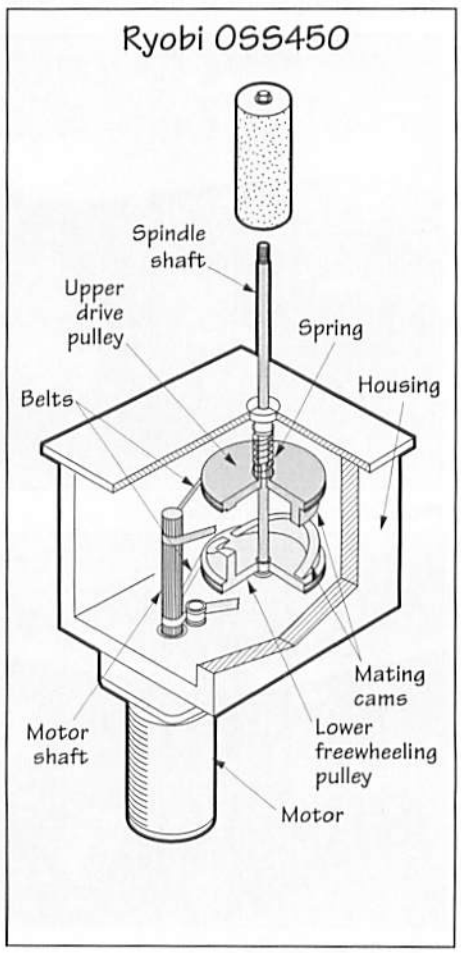
Sanding Accuracy. A spindle sander should sand a perfectly straight, square edge. Three factors affect this accuracy. First, the table must be perfectly flat and the spindle oriented exactly perpendicular to it. Second, the spindle runout must be true, with minimal or no wobble. Third, the spindle must not flex or bend (i.e., move out of alignment when lateral pressure is applied).

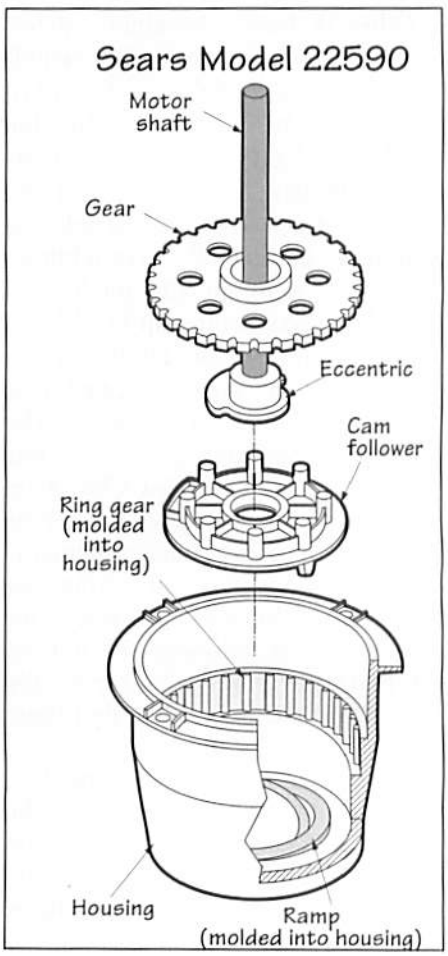
To check table flatness, I placed a straightedge diagonally across the top. The Sears won this contest with an almost perfectly flat table. On the Ryobi and Powermatic units, the table had a slight crown—it was a hair or two higher in the center than at the edges. My feeler gauge showed that the Powermatic table was flat within about .012" (edge-to-edge), the Ryobi, within .010", and the Sears within .004". In practical terms, you won't get a good, square edge on wide stock if the table is off by .015" or more. The table on each of these machines was flat enough to ensure reasonably square edges.

Next, I placed a square against the spindles to check for perpendicularity to the table. Again, all units passed. The Powermatic, I noticed, had a small shim under one of the four bolts connecting the table to the base to square it. However, because the Powermatic has a tilting table, you still need to square it to the spindle (front to back) by means of a leveling screw (located under the table) after using it in the tilted position. On all of the machines, one can easily shim the table and base to correct spindle/table alignment problems.

To check spindle deflection, I simply grabbed the spindle on each machine by hand and applied pressure to flex it out of alignment. I noticed a minor amount of flex at the top of the spindle on all three machines, but not enough, in my estimation, to affect sanding performance. Bear in mind that most of the sanding you'll do will involve only the lower half or third of the drum, where spindle deflection is minimal.







SPECIFICATIONS: OSCILLATING SPINDLE SANDERS

Make	Model	Amps. @120v	Spindle Speed (RPM)	Strokes Per Minute (1)	Stroke Length (In.)	Drum Length (In.)	Maximum Sanding Height (In.) (2)	Drum Diameters (In.)	Table Size (In.)	Overall Dimensions HxWxD	Net Weight (Lbs.)	Average *Selling* Price (3)
Power-matic	Artisan 14	9	1,720	30	⅞	5½	3⅛	¼,½,¾,1½ 2,3*	14½x14½	19x 14½x14½	76	$300.00
Ryobi	OSS450	3.5	2,000	58	⅝	4½	3¼	½,¾* 1,1½* 2*,3*	14x20	13½x 14x20	26	$175.00
Sears	22590	3.2	1,725	60	¾*	4½	3½	½,¾* 1* 1½* 2,3*	20x20	11⅞ x 20 x 20	30	$150.00

Notes: 1. Oscillations (up/down) per minute.
2. Thickest piece of stock you can sand.
3. Average street price for Powermatic and Ryobi; catalog/store price for Sears.

Asterisk (*) indicates optional drums and sleeves. Sears and Ryobi units come with throat plates for all sizes.

Finally, I checked spindle runout (wobble) using a dial indicator. (Runout is defined as the greatest distance that the spindle travels horizontally away from its fixed vertical axis.) All three sanders fell within respectable ranges for any woodworking machine: the Powermatic had a runout of about .004"; the Ryobi, .005"; the Sears, only .0025". I noticed no chattering on any of them during sanding. All of the units were new, however, and it wasn't possible to determine how much they would wear, or how wear might affect performance. In lieu of these tests, you can make one simple check: sand the edge of a piece of thick wood, then test its squareness using an accurate try square.

Tables. A larger table provides more support for large workpieces. The Sears sports the largest table, followed by Ryobi, then Powermatic. (See the chart *above* for comparative dimensions.)

The Ryobi and Sears have tables made of medium-density fiberboard (MDF) covered with plastic laminate. The Powermatic uses a polished cast-iron table. I found that my workpieces slid freely on all table tops with no appreciable drag. A laminate top generally provides a slicker surface when new, but is more vulnerable to scratches and dents than cast iron. As already mentioned, the Powermatic has a tilting table—a feature that comes in handy for sanding beveled edges (*photo 4*).

The tables on the Ryobi and Sears sanders come with metal table inserts that fit all of the variously sized drums, providing support close to the drum for sanding small parts. The thin, lightweight, and loosely fitting aluminum inserts on the Sears tended to rattle as the machine vibrated. The Ryobi uses thicker, heavier steel inserts that fit snugly into the table. The Powermatic comes with four inserts, which, unfortunately, fit only the 1" and 2" drums (a flat-sanding and a bevel-sanding insert for each). The company offers an optional insert for 3" drums (about $5), but I'd like to see inserts for the rest of their drums offered as well.

Photo 4: Table on Powermatic tilts 45° in both directions to sand beveled edges. Dust collection is less efficient with table tilted as shown.

Changing Drums. To change drums on the Ryobi and Sears, you simply remove a nut and washer on top of the spindle (wrenches provided), pull off one drum, slide on another one, and retighten the nut. Sanding sleeves fit over the drums, and tightening the nut and washer expands the drum, holding the sleeve firmly in place. Both of these sanders have ½"-diameter spindles that accept 4½"-long drums and sleeves of ¾" to 3" diameters. The ½"-diameter abrasive sleeves fit directly over the metal spindle. Drums and sleeves are interchangeable between these two machines.

The Powermatic uses a combination of spindles and drums that accept 5½"-long sleeves of various diameters. (See *photo 5.*) Smaller-diameter sleeves (¼" and ½") fit directly over same-sized spindles (without a drum) and are held in place by a retainer clip at the spindle base. A third, ⅝"-diameter spindle accepts drums of ¾" to 3". (See the chart for all size options.) The latter spindle has a keyway that fits a corresponding slot in the rubber sanding drums to hold them in place. Although the

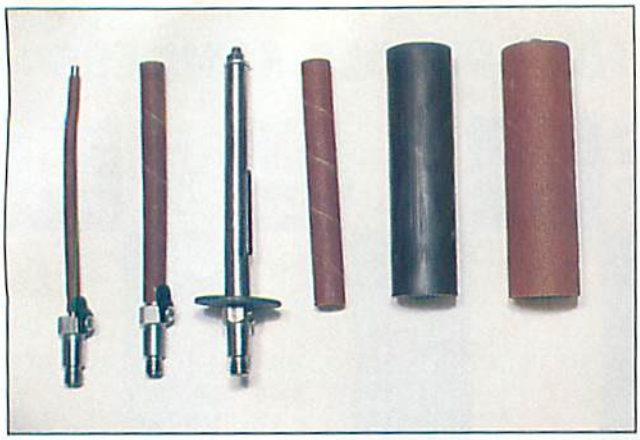


Photo 5: The Powermatic uses a combination of different spindles and drum sizes to accept ¼"- to 3"-diameter sanding sleeves.

Powermatic accepts ¼"-diameter sleeves, I felt it a bit of a hassle to change to them because you need to remove and replace the spindles from underneath the table (two wrenches provided for this).

Dust Collection. Spindle sanders generate a lot of dust, and all three units have dust-collection ports. Hooked up to my shop vacuum, all worked efficiently, although the Powermatic was a bit less effective when the table was tilted. In this mode, the vacuum was able to capture only about three-fourths of the dust produced.

The ports on the Ryobi and Sears fit a standard 2½"-diameter shop-vacuum hose (*photo 6*). The slightly undersized 2" port on the Powermatic makes connection more difficult. Powermatic rep Mark Seymour tells me that the port was sized to fit older-style shop vacuums with smaller

If you don't have room for a dedicated machine, why not consider one of these handy attachments that oscillate a sanding drum on your drill press?

G.P. Designs. This ingenious device was invented by retired machinist Gene Paules, who sells it either fully assembled ($169) or in kit form ($10 less). The attachment consists of a small motor that you mount on the back of the drill press *(photo 9)*. It drives a connecting rod that you attach to one of the quill feed levers. The cam-driven rod alternately pushes and pulls on the lever to move the quill up and down.

Although the device falls within the same price range as the Sears and Ryobi spindle sanders, it has several advantages over the dedicated machines. For one, it doesn't take up any shop space. To switch from sanding to drilling mode, you simply detach the connecting rod from the lever. That takes about two seconds.

Compared to these dedicated units, drill presses will accept a much wider variety of sanding drums, including the tiny ones sold for Dremel Moto Tools and those drums that accept less expensive sheet sandpaper instead of sleeves. Depending on where you position the rod on the lever, you can adjust the stroke length from ⅛" to ⅝". And, because you can change drill-press spindle speeds, you can better match operating speed to the drum size. (Small-diameter drums sand more efficiently at fast speeds, whereas large-diameter drums work better at slower speeds).

According to inventor Paules, the unit fits just about any drill press he's ever run across. When ordering, you specify the drill press it will be used on, and the appropriate mounting hardware will be supplied in the kit. Radial and benchtop drill presses require an additional mounting brace to support the motor.

My buddy Bob and I installed the device on his Delta 12" benchtop drill press in about 35 minutes. We could have done it faster had the instructions been a bit more concise. The directions also include plans for a handy auxiliary vacuum table. You simply make a plywood box and tabletop to fit over your present drill press table, rout a rabbeted cutout in the top for inserts, and bore a hole in the side for your vacuum hose. (I glued a piece of plastic laminate to the tabletop to provide a smoother surface).

G.P. Designs offers *optional* plastic table inserts for drums of various sizes, or you can make your own inserts from

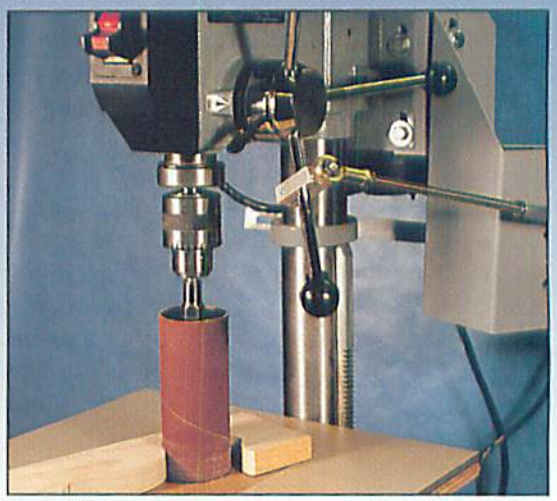


Photo 9: The drill-press oscillating sanding device from G.P. Designs uses a motor-driven connecting rod to move the drill press feed handle up and down.

tempered hardboard. The instructions tell how to modify the auxiliary table and inserts for bevel-sanding if your drill press has a tilting table. It also shows how to make a pivoting fence attachment for sanding perfectly parallel edges. You can use the entire surface of a sanding drum simply by raising or lowering your drill-press table.

Based on my tests, I gave this sturdy, well designed attachment high marks. However, sanding accuracy will depend largely on the quality and condition of your drill press and on how precisely you cut and fit the parts for the auxiliary table. The one drawback I found with it was the number of electrical cords involved–one for the drill press, one for

Photo 6: Dust port on Sears (shown here) and Ryobi fits 2½"-diameter hoses. Under-table ducting, similar on both machines, provides good dust evacuation.

hoses. The company is looking into the problem, but he didn't specify when any change would be made. While I wasn't able to find an adaptor to solve the problem, I did manage to rig a reasonably firm connection using a 2" "no-hub" pipe connector, purchased for about $4 at a local plumbing-supply store *(photo 7)*. (I've also heard of using wide rubber bands cut from bicycle inner tubes to connect hoses of different sizes. Or, you can wrap a few turns of duct tape around the dust port and then attach the vacuum hose with a hose clamp.)

With the vacuum attached to the Ryobi and Sears machines, both made an intermittent whistling noise as the spindle moved up and down, louder on the Sears than the Ryobi. Air rushing through the gap between the spindle and the table insert produced the noise, sort of like whistling between your teeth. Although I found the noise irritating, it didn't affect performance.

the oscillating unit, and one for the vacuum. Add a work light, and you have four of them to contend with.

Edgemaster. The Edgemaster *(photo 10)* works in reverse fashion with respect to the G.P. Designs attachment. Instead of making the drill press oscillate, the drill drives the Edgemaster. The spindle is powered by a drive-pin assembly (attached to the top end) that you chuck into your drill press. The drive pin fits into an elongated slot milled into a knurled spindle nut, which provides enough play for the spindle to move up and down. The bottom end of the spindle, fixed permanently to an oscillating mechanism housed inside the base of the unit, is driven by the rotary motion of the spindle, so a second motor isn't needed.

The spindle accepts 2"-long rubber drums and sleeves of ¾" to 3" diameters. The unit comes with two drums (¾"- and 1½"-diameter), including washers, a table insert, and two sleeves for each. An optional drum and sleeve kit offers 2"- and 3"-diameter drums with washers and table inserts and an assortment of sanding sleeves (six of each drum diameter–two coarse, two medium, and two fine). Also, many hardware stores sell 2" drums and sleeves (as accessories for portable electric drills) that work on this unit, so you shouldn't have any trouble finding extra sleeves.

Due to the short length of the drums, the spindle travels only ⅛". However, it makes one oscillating cycle for each revolution of the drum, which is considerably faster than what you get with the dedicated machines. The manufacturer claims that this rapid rate keeps the abrasive sleeves from loading up and increases their sanding efficiency.

I found the unit to be well made, with a nicely finished melamine table and base that features plastic edge banding. The base has slotted mounting holes that correspond to the slots in most drill-press tables. The unit also includes a 1¼"-diameter vacuum port for household-type vacuums. (Some shop systems also have adapter fittings to accept this size of port.) The Edgemaster fits most drill presses, including the small benchtop machines. However, the relatively small (10 x 14") table and short drum length limit the overall size and thickness of pieces you can sand conveniently on it. Because of this limitation, I consider the Edgemaster more of a hobbyist's device and at best suitable primarily for smaller projects.

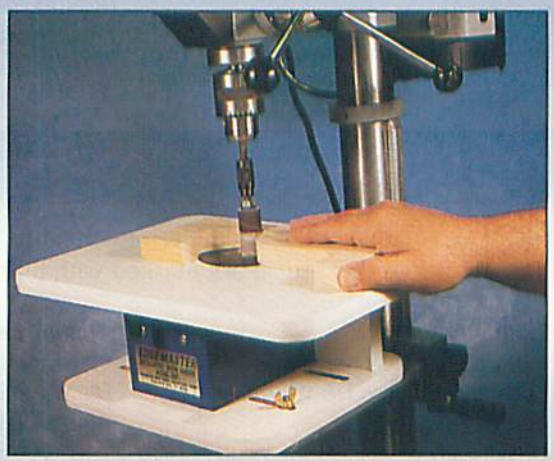


Photo 10: On the Edgemaster, rotary drum motion drives an oscillating mechanism housed inside the unit's base to produce the dual sanding action.

However, the device did produce very smooth, square edges and also removed stock quickly. On the down side, I found changing drums to be tedious. You have to detach the spindle from the drill chuck, then remove the drive pin assembly, spindle nut, and two washers from the spindle before you can slip off the drum. You then reverse the procedure to remount a drum. A spindle lock built into the base of the unit holds the spindle steady while you do all of this. The spring-loaded lock was a bit stiff and hard to align with the flats on the spindle, requiring one hand to keep the lock depressed while the other hand changed drums. This I found cumbersome.

While not quite as versatile as the G.P. Designs attachment, the Edgemaster removes easily from the drill press and stores on a shelf when not in use. The unit sells for $99.95 (including shipping) through Penn Keystone Corp.

Also In the Works. Delta currently has an oscillating sander under development for retrofitting to their drill presses. Although an operating prototype was exhibited by the firm at the International Woodworkers' Fair in Atlanta last summer, a production unit wasn't available in time for testing. The sander will go on sale this spring–possibly by the time you read this.

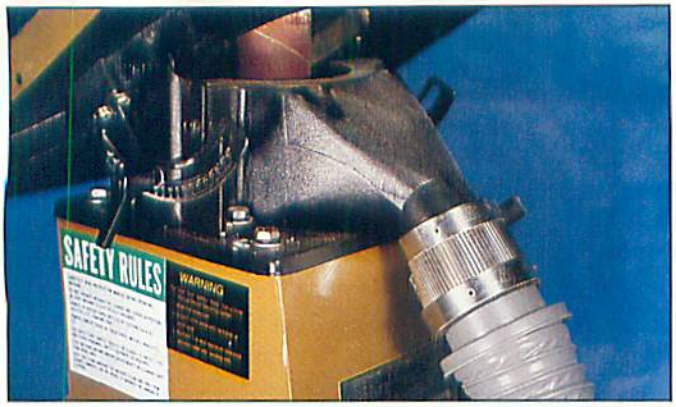


Photo 7: Undersized dust port on Powermatic makes connecting to 2½" shop vacuum hoses difficult. Note the jury-rigged connection used by author during testing.

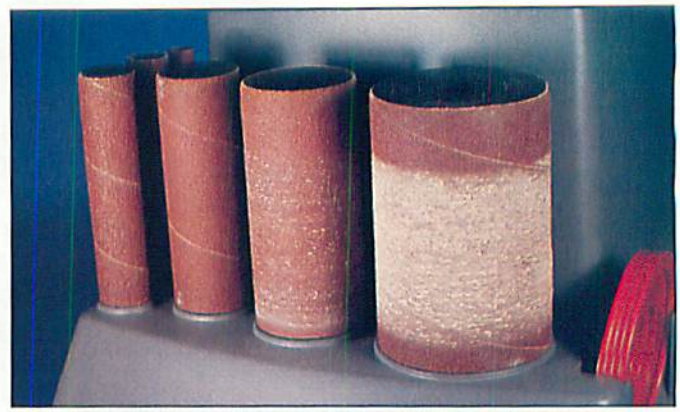


Photo 8: The Ryobi provides convenient on-board spindle and table-insert storage built into the base. The Sears model (not shown) provides a clip-on tray for these parts.

Other Features to Look For

The manufacturers tout their sanders as benchtop machines, but when I placed them on a standard-height bench, I found the sander tables were too high to work at comfortably. For comfort's sake, you'll probably want to build a lower bench to set the machines on, or stand on a low platform. All three units have on/off switches, with plastic "remove-to-lock" keys, located conveniently on the front of the machine. The Ryobi incorporates on-board storage for drums and table inserts, which is built into the base (*photo 8*). The Sears comes with a clip-on drum/insert storage tray that you can attach to the base, set on a bench, or mount on the wall.

Parting Shots

All three sanders represent good value for the money. While the Powermatic features solid construction, smooth, quiet operation, and a tilting table, it costs nearly twice as much as the Sears and Ryobi units. At just over 75 pounds, it's also a mite heavy to lift on and off the bench. However, if you plan to do much bevel-sanding, this would be the sander to go with. Also, its ¼"-diameter sleeves are great for getting into tight places.

Choosing between the Sears and Ryobi is a toss-up for me. Both weigh under 30 pounds, making them easy to lift or move about. I personally liked the larger table on the Sears, which also scored the highest marks for flatness. The high-pitched motor noise on the Ryobi was somewhat irritating, but so was the whump-whump noise in the Sears' oscillating mechanism. WW

Illustrations: *Dan Thornton*
Photographs: *Jim Barrett*

Sources

The following companies make oscillating spindle sanders or sander attachments for drill presses. Manufacturers of the machines reviewed in this article are marked with an asterisk (*).

Clayton Machine Corp.
P.O. Box 513
Clawson, MI 48017
800/971-5050

Crouch Machinery Inc.
6516 Seven Lakes Village
West End, NC 27376
800/334-1948

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Enlon Imports
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City of Industry, CA 91748
800/888-9697

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203/929-8158

Grizzley Imports, Inc.
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Bellingham, WA 98227
800/541-5537
East: 2406 Reach Rd.
Williamsport, PA 17701
800/523-4777

***Powermatic**
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McMinnville, TN 37110
800/248-0144

***Ryobi America Corp.**
P.O. Box 1207
Anderson, SC 29662
800/525-2579

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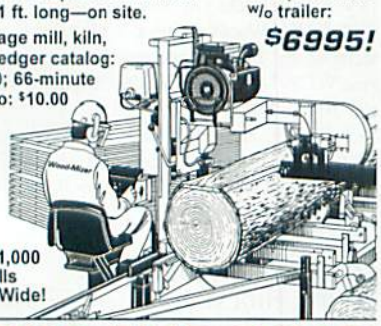

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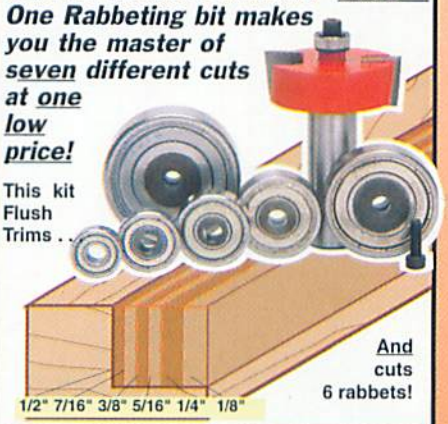

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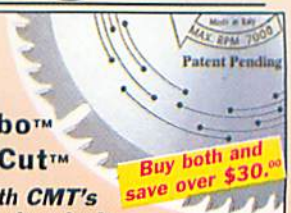

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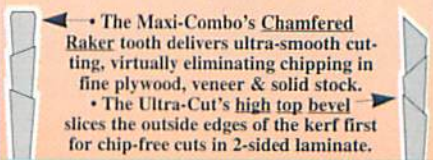

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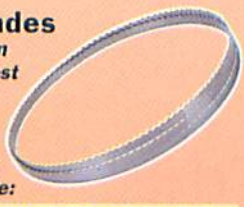

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